ELECTRICAL REVIEW

and WESTERN ELECTRICIAN with which is consolidated ELECTROCRAFT

VOL. LXII. No. 23. CHICAGO, SATURDAY, JUNE 28, 1913. ISSUED WEEKLY.

COMPRISING

ELECTRICAL REVIEW WESTERN ELECTRICIAN ELECTROCRAFT

ELECTRICAL REVIEW PUBLISHING COMPANY
608 SOUTH DEARBORN STREET
CHICAGO

Charles W. Price, President and Treasurer.
A. A. Gray, General Manager. H. S. Tuthill, Business Manager.
J. B. McCarthy, Asst. Gen. Mgr. C. W. Forbrich, Asst. Bus. Mgr.

E. E. Wood . . . . . 13 Park Row, New York, N. Y.
Manager Eastern States.
J. B. McCarthy . . . . . Detroit, Mich.
Manager Middle States.
C. W. Forbrich . . . . . Chicago, Ill.
Manager Western States.

ELECTRICAL REVIEW AND WESTERN ELECTRICIAN

Charles W. Price.....Editor-in-Chief
A. A. Gray.....Managing Editor
Morton Githens Lloyd.....Technical Editor
F. H. Bernhard.....Associate Editor
Howard Ehrlich.....Associate Editor
J. E. Latta.....Associate Editor

SUBSCRIPTIONS.

One Year, United States.....$3.00
One Year, Canada..... 4.00
One Year, Foreign Countries..... 6.00
Single Copy, 10 cents. Back numbers, beyond one month, each .25

Entered as second-class matter, November 7, 1908, at the Post Office at Chicago, Ill., under the Act of March 3, 1879.

CONTENTS.

EDITORIALS:
Improvements in Textile Motor Driving.....1353
Assembling Unit Wiring Costs.....1354
President Vail and the Western Union Telegraph Company.....1354
Simplifying Our Units.....1355
Safeguarding Temporary Line Installations.....1355
DEPARTMENTS:
Commercial Practice.....1364
Electrical Construction.....1368
Public Service Commissions.....1375
Questions and Answers.....1376
New Electrical and Mechanical Appliances.....1386
Current Electrical News.....1393
Record of Electrical Patents.....1399
LEADING ARTICLES:
A Notable Group of War-Time Telegraphers.—By Walter P. Phillips.....1357
Electricity in Book-Binding Plants.....1359
The Unit Well System—An Experimental Water Substation and Deep Well at Rockford, Ill.—By G. G. Crane 1364
Electrical Work in the Pacific Mills' New Print Works Department.—By Theodore A. Bergen.....1368
Electric-Garage Equipment and Management.—By H. M. Martin.....1382
BOOK REVIEWS.....1384
MISCELLANEOUS:
Meeting of Electric Motor Car Club.....1356
Milwaukee Electric Show.....1356
American Institute of Electrical Engineers Holds Annual Convention.....1356
Navy Wireless Station at Balboa.....1358
Chicago Section, Electric Vehicle Association of America 1358
Conditions at Rome, Ga.....1364
Interesting Window Display.....1367
Reduced Rates in San Francisco.....1367
Power for Coal Mines.....1367
Boston to Have Great White Way.....1367
230-Volt Motors to be Required in Chicago.....1371
House-Wiring Campaign in Chicago.....1371
A New System of Conduit Work.....1372
Electricians Locked Out in Chicago.....1374
Among the Contractors.....1374
Meeting of Illinois Electrical Contractors.....1378
Electric Club Report on Patent Legislation.....1379
English Standardization Rules.....1381
A Comparison of Arc and Spark for Radiotelegraphy.....1381
Engineering Positions Open.....1381
A Unique Electric Street Light and Marker.....1384

Copyright, 1913, by the Electrical Review Publishing Company.

IMPROVEMENTS IN TEXTILE MOTOR DRIVING.

The electrification of the textile industry continues, to the increasing satisfaction of the plant owner, the manufacturer and the engineer seeking economical production. Figures recently come to hand indicate the present use of at least 10,000 motors in individual drives in cotton-mill service in this country, and the application of small motors on the loom shaft has now become thoroughly standardized. A typical single installation, which in 1904 was group-driven by one 350-horsepower motor, is now operated by 1,200 motors of one-third-horsepower rating each, and all the evils associated with belts and shafting are eliminated. A five-horsepower motor for individual service may be in itself five per cent less efficient at full load than a larger machine, but engineers experienced in textile power applications have found out that there may easily be a net saving of 15 per cent by its installation, through the taking out of belt and shaft losses. Even the one-third-horsepower motor has an efficiency of about 82 per cent at full load and at a first cost of approximately $40 it provides an ideal drive on account of its compactness, freedom from accident hazards, cleanliness and reliability.

The induction motor has been favored for textile-mill service and it should not be forgotten by central-station men seeking this class of business that once the investment is made, the expense required to carry the motor is but a few cents a month. A one-horsepower induction motor for textile service can be purchased for from $50 to $55 and the first charges and maintenance expenses upon such a machine seldom exceed a dollar a month under the most unfavorable conditions,—a small sum indeed in comparison with the output value of the textile mechinery which the motor will drive. Carding and drawing frames are still largely driven on the group plan, but all the rest of the equipment of the modern cotton mill has become thoroughly adapted to individual operation, with its greater regularity of rotation and resulting increased production. Of course, a large number of group-driven mills are in successful service and the so-called four-frame drive of spinning machines from one overhead motor is deservedly popular, but more and more the tendency shows itself for the single motor per machine to be selected.

A recent feature of the four-frame drive which commands interest is the use of paper pulleys with a

crown of about 0.5-inch per foot and an intermediate recess 0.5-inch wide between each pair, which aids materially in keeping the short belts in place. Other improvements in textile motor driving include the mounting of the motor eccentrically upon the machine shaft, enabling a constant relation to be maintained between the motor and its support; and the use of waste-packed, "fool-proof" bearings instead of the ring-oiling type.

Thus far the steam-driven central station has made less headway in the field of large textile power service than the hydroelectric systems, but as the use of electricity increases in textile centers for other purposes it is probable that better arrangements can be made for the reciprocal use of plants representing a large investment in each case and therefore costly to carry from the financial point of view. With power rates tending downward there appears to be an opportunity here for negotiation and the standardization of large steam turbines for both mill and central-station service is likely to be a controlling factor in plant centralization within the next few years. The large turbine can come exceedingly close to the hydroelectric plant now in production economy, and as central stations grow in size and local influence there is little doubt that much textile work now handled by isolated plants will be secured by the former.

ASSEMBLING UNIT WIRING COSTS.

Simple and rapid methods of estimating wiring costs are among the most useful resources of the progressive central station. The opportunities for good work in this field are almost unlimited. One of the most valuable contributions to the data of residential and apartment house wiring costs that has lately been published is the report of the Committee on Wiring of Existing Buildings, at the recent National Electric light Association convention. Such a compilation represents long and painstaking work in the study and interpretation of accounts bearing upon construction items, and furnishes a basis for investigation and comparison of the most concrete value.

As in the power field, there is a real need in many central stations of more accurate information upon wiring costs. Too often analysis of such jobs are omitted, or through lack of time or of complete figures, there are yielded few unit data which can safely be used a second time. One of the most desirable things in central-station practice is to be able to make rough, overall preliminary cost estimates on wiring jobs representing comparatively small total investments, leaving to the contractor the responsibility for careful detailed estimates on larger work. A larger percentage in the contingency allowance on a small job means less to the consumer in actual dollars and cents than a much smaller error in estimating the cost of a big installation. No central station can err in collecting wiring costs and reducing them to units on all sizes of jobs, but the more these approximate lines of attack can be prepared in connection with the smaller installation, the better it is for the increase of such business.

There is a demand for more approximate estimates in many central stations than the exhaustive report of the Wiring Committee covers; costs less accurate in detail, but large enough to represent "outside figures" in talking with prospective customers. Such costs may be prepared upon the basis of the total number of outlets in a house or apartment of a given size and checked upon the per capita accommodations, floor areas or other units such as the investment per foot of wire or per kilowatt of connected domestic load. What is needed is a preliminary scheme of estimating, such as would be used by an energetic real-estate man in giving a customer an over-all figure which would probably not be exceeded in making the actual installation. The increasing tendency of the times toward apartment-house life facilitates rough estimates of this kind, as there are enough standard room arrangements and outlet locations to enable a great number of unit costs to be assembled for fairly similar conditions. The large private residence with highly distinctive architecture does not fall within this class of estimates, but its cost justifies more elaborate preliminary studies of electrical layouts.

Central stations which have failed in the past to accumulate ample cost data can make a good beginning along just this line, massing material on buildings of the same general character and keeping card-index or loose-leaf statistics of each new job, with full particulars as to dates, sizes of rooms, number of outlets, size of wire and character of construction employed. By continuing such work it will in time yield enough data to permit the plotting of curves showing the cost of wiring for rooms of specific kinds with varying outlets and sizes, with enough accuracy for over-all estimates. We believe that a larger confidential interchange of wiring cost data between central stations and contractors is desirable in the interests of reducing the amount of preliminary work required in ordinary estimates, and that such a program would result in increased efficiency among all parties concerned.

PRESIDENT VAIL AND THE WESTERN UNION TELEGRAPH COMPANY.

Since Theodore N. Vail was elected president of the Western Union Telegraph Company, in November, 1910, the number of offices of that company has increased from 25,000 to 67,000, and in another twelve months will probably exceed 100,000. In addition, throughout the United States, wherever Western Union offices are located, a noticeable improvement in point of attractiveness and convenience is now evident. The activity and constant alertness of Mr. Vail—who, in addition, is the head of the vast Bell

telephone interests of the country—at a time of life when most men of his means would have retired from active participation in business affairs of the day, is at once an inspiration and an encouragement to young and old alike. Mr. Vail is uniquely well equipped by experience and ability for the peculiarly responsible and influential positions he holds, and directs these large interests in a broad and progressive spirit.

SIMPLIFYING OUR UNITS.

The English-speaking peoples have been burdened for years with the most incongruous collection of units of measurement which could well be imagined. As this collection of units first developed there was no simple relation between the units for measuring different kinds of quantities, but worse than this, the ratios between units of the same kind were not simple. Thus we have 231 cubic inches in the gallon (in the United States; in England it is 277.27 cubic inches) and 5.5 yards in the rod.

The general tendency, with the greater development and use of measurements and computations, has been to eliminate the more cumbersome of these units and reduce their number to a minimum. Thus in the American monetary system the different units have a simple decimal relation; among surveyors the use of decimal fractions of the foot has displaced the use of the inch; and cubic inches and cubic yards take the place in most engineering work of the gallon or other unit of volume. Similar tendencies are to a less extent to be noted in commercial work as well as in engineering. Great Britain and the British colonies are making changes in the same direction. A number of the colonies have taken definite steps toward the adoption of the metric system, and a recent announcement of the Board of Trade in England, whose Standards Department has jurisdiction over units of measurement, is that the metric carat of 200 milligrams has been adopted as standard for the United Kingdom.

The movement to entirely eliminate, however, the principal units in the English system has made little headway either in this country or in England, and the foot, the pound, etc., seem to retain their hold in spite of the greater simplicity of the metric system. This is largely due to the effect of habit, since anyone finds it easier to measure, to make calculations and to think in terms of those units with which he is already familiar.

Fortunately in electrical engineering this condition of being accustomed to an irrational system did not exist to hamper the selection of suitable units, and the result is that the electrical units have simple relations with each other and are used in decimal multiples or submultiples. With this example and with that of our monetary system before us it really seems strange that greater progress is not made towards the adoption of a rational system of measurement.

Such progress must depend upon familiarizing the younger generation with the advantages of the simpler system. Unfortunately school instruction at the present time does not effect this result, since what nominal instruction in the metric system is given usually is concerned with conversions between metric and English units. It has exactly the opposite effect to that which is desired and does not indicate the simplicity of the metric system in itself.

When it comes to the work of the engineer as it is taught in the universities and technical schools, consideration of this question upon the part of instructors in engineering subjects would undoubtedly lead in the course of a generation to a different attitude upon the part of engineers themselves. If the advent of the efficiency engineer is to have its rightful influence upon manufacturing and engineering affairs, it should concern itself with this subject, since there is at the present time great loss in efficiency of human beings due to a lack of use of the simplest methods in this field. Unfortunately many professors of engineering subjects in our colleges are not very enthusiastic on this subject, and instead of pointing out to their students how to do things in the simplest way, they seem to take a pride in copying the worst habits of the men in commercial and active engineering life, and in consequence pose as "practical" men. If these leaders of the younger generation would be careful to inculcate in the student only those current practices which will be a help to him and to teach better ways where this is possible, greater progress toward human efficiency would be attained.

SAFEGUARDING TEMPORARY LINE INSTALLATIONS.

The importance of maintaining a high standard of workmanship in temporary line installations should be frequently impressed upon the linemen. The central-station officials in charge of line work should not wait until an accident occurs before knowing that the employees have been careless in temporary overhead construction, but should know that safe line work is being installed continually.

A central station operating in a Southern city ran a line to a tent where moving pictures were to be exhibited. The wires were strung on supports that were not the proper height above ground, and were permitted to sag across a walk leading to the tent. A tall boy approaching the tent raised his hands to lift the wires higher above his head and was instantly killed. An examination of the line after the accident showed that the insulation was frayed where the boy came in contact with the wires. The fact that the installation was temporary doubtless was a reason why more care was not exercised by the linemen, resulting in a death and considerable expense to the company. There can be no excuses for such accidents as this.

Meeting of Electric Motor Car Club.

The membership of the Electric Motor Car Club of Boston was increased by the addition of four, at the meeting held June 19 at the Thorndike, Boston. The club has now 110 on its rolls.

The Committee on Country Club facilities reported that the Walpole Inn, 18 miles from Boston, would provide accomodations and is having a charging station installed.

Electric vehicle registrations for New England were reported as follows:

Maine, 3 passenger, 3 commercial; New Hampshire, 15 passsenger, 2 commercial; Vermont, 3 passenger, 2 commercial; Massachusetts, 497 passenger, 363 commercial; Rhode Island, 15 passenger, 8 commercial; Connecticut, 220 passenger, 30 commercial. Total, of both classes, 1,161. The gain in electric-vehicle registration over a year ago, in Massachusetts, is 127 passenger cars, or 38.3 per cent; and 180 commercial vehicles, or 98.3 per cent.

The number of charging stations was reported by states as follows:

Maine 25, New Hampshire 17, Vermont 12, Massachusetts 121, Rhode Island 5, Connecticut 28—total 208.

The Club adjourned early to attend a meeting of the New England Section, Electric Vehicle Association of America, at the Edison Building. Fred W. Kimball, chairman, presided, and Alexander Churchward, consulting engineer, of New York, read a paper on "Tire for Electric Vehicles."

Mr. Churchward presented data to show the varying degrees of energy consumption of tires of several makes. With the Palmer single-tube tire as a unit, a second tire required 15 per cent more watt-hours per ton mile, a third tire required 32 per cent more and others 33, 43, 58 and 63.5 more respectively, these tires being of wellknown makes, especially constructed for electric vehicles. He found a standard pneumatic gasoline tire required 69 per cent more energy, while solid tires consumed 42 to 110 per cent more than the Palmer single tube. Some special tires of the "block" type took only 40 per cent more energy than the Palmer, this being due to the good material of which they were constructed. The writer of the paper tested an electric runabout with 30 cells of 15 thin-plate battery and got with Palmer double-tubed tires 155 miles at a speed of 16 miles per hour; with another make of electric tires he got 82 miles at the same velocity, while with ordinary pneumatics 68 miles were obtained, and with solid tires the same mileage. Mr. Churchward advocated the standardization of tires by tractive effort per ton mile, and has enlisted the co-operation of the Standardization Committee of the Electric Vehicle Association of America.

James E. Hale, of the Goodyear Tire and Rubber Company, Akron, O., followed with a description of modes of construction of tires especially adapted to electric vehicles. He expressed great confidence in the growth of the electric-vehicle industry and said his concern was eager for data which should aid in the perfection of a tire which will best meet the requirements of storage-battery cars, the main desirable qualities being low power consumption, easy riding, and few "tire troubles." It is a difficult problem to combine these qualities in proper ratio, there being great difficulty in securing durability together with a flexible construction that gives low energy consumption. The Goodrich Company now manufactures an efficient tire with soft base, reinforced with cross wires.

The discussion was engaged in by W. W. Duncan, of the Hood Rubber Company, Watertown, Mass.; T. H. Giehan, Motz Tire & Rubber Company, Akron, O.; and Day Baker, New England representative of the General Vehicle Company. The latter advocated dual five-inch tires for five-ton trucks, though on hilly roads a somewhat larger tire might be found more efficient. Mr. Baker stated that over 1,300 commercial vehicles of this type and equipment are in service at the present time.

Milwaukee Electric Show.

An interesting electrical exhibition, in which was shown various electrical apparatus of student manufacture, was held in Milwaukee, Wis., on June 19, 20 and 21 under the auspices of the School of Engineering, Milwaukee. One of the features of the exhibition was a model house completely wired, equipped with door bell, burglar alarm, vacuum cleaner, electric fan, washing machine and numerous other devices illustrating the conveniences of domestic electrical appliances.

The Wisconsin Telephone Company had installed a complete telephone exchange, which was shown in operation, and 57 manufacturers of electrical appliances maintained exhibits. Thirty-four pupils of the School gave actual tests and demonstrations in electrical laboratory work.

Chicago Electric Vehicle Section To Continue Weekly Meetings.

The weekly meetings of the Chicago Section, Electric Vehicle Association of America, will be continued throughout the entire summer. There will be something of interest every week.

These meetings are held in the rooms of the Traffic Club on the eighteenth floor of the Hotel La Salle.

American Institute of Electrical Engineers Holds Annual Convention.

The annual convention of the American Institute of Electrical Engineers opened auspiciously, with an attendance of over 150, with a reception and dance on Monday evening, June 23, retiring president Ralph D. Mershon, president-elect C. O. Mailloux, Dr. D. C. Jackson and F. L. Hutchinson heading the reception line. Headquarters were established at the Otesaga Hotel, Cooperstown, N. Y.

At the first session on Tuesday morning Mr. Mershon delivered the presidential address, noting the expansion of the Institute's work particularly with reference to the labor of the new technical committees and the new local sections. A limitation is placed upon the work of the Institute due to the expense now imposed upon its resources, and it will be necessary to consider how the expense of printing particularly can be curtailed. Economics in engineering are receiving more attention from the wider modern viewpoint. Mr. Mershon suggested increasing the numbers of the board of directors so as to give wider geographical representation and also greater publicity to its proceedings. He introduced Mr. Mailloux, who made a gracious response, urging activity of the engineer in the field of public affairs.

A telegram of sympathy was sent to Elihu Thomson who is indisposed.

The paper entitled "A Suggestion for the Engineering Profession," was presented by William McClellan, and a motion was passed endorsing his suggestion and referring it to the board of directors. The paper entitled "Test of An Artificial Aerial Telephone Line at a Frequency of 750 Cycles per Second," by A. E. Kennelly and F. W. Lieberknecht, was presented by E. H. Colpitts. This was followed by the presentation of a paper entitled "The Adaptation of Automatic Methods to Long-Distance Telephone Toll Switching," by H. M. Friendly and A. E. Burns. This paper was presented by Mr. Friendly. The paper entitled "Electrolytic Corrosion of Iron in Soils," by Burton McCollum and K. H. Logan, was read by Mr. McCollum. Each paper was briefly discussed separately.

Power-House Accident in Germany.

A 5,000-kilowatt, 5,250-volt Zoelly steam turbogenerator recently burst all to pieces in a power house at Essen, Germany. No one was hurt, but parts of the machine flew in all directions, through the roof and one of the walls; an adjoining unit was set on fire and destroyed. The other machines were not seriously damaged, however, and the supply of current was interrupted only five minutes.

A NOTABLE GROUP OF WAR-TIME TELEGRAPHERS.

By Walter P. Phillips.

The accompanying picture was taken in 1908 by Charles H. Davis, an ex-telegrapher and the founder and former owner of the Fifth Avenue studio of Davis & Sanford, New York.

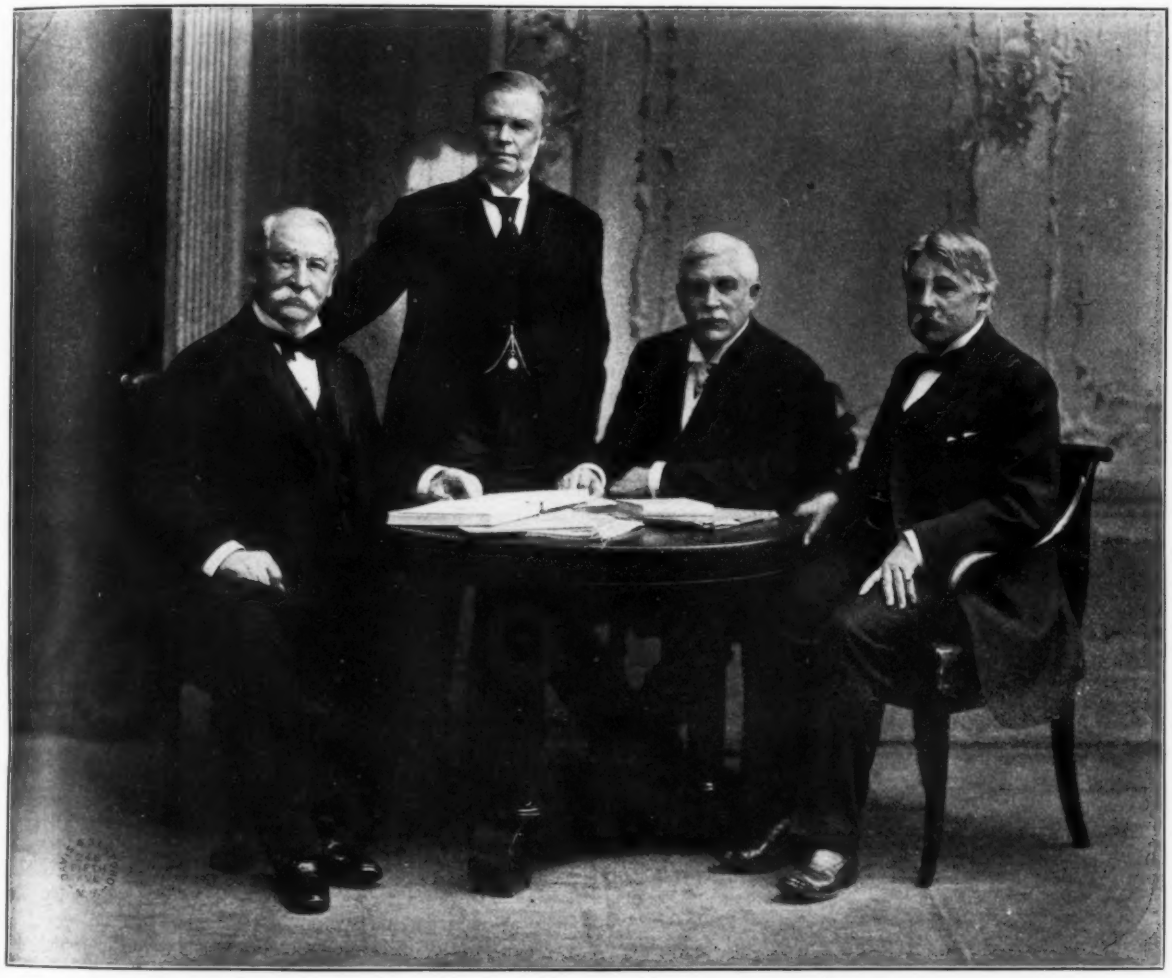
General Eckert, who has now passed away, was the man selected by Mr. Lincoln to accompany him to Ford's Theater on the night when the President was assaulted by John Wilkes Booth, and whose bullet caused his death the next morning at 7:30 o'clock. Mr. Lincoln was extremely desirous that General Grant should go with him, but Secretary Stanton spirited General Grant and his wife away to New York by an afternoon train, hoping in that way to overcome Mrs. Lincoln's insistence on seeing Laura Keene in "Our American Cousin."

General Eckert was then requested to accompany them, but Secretary Stanton objected so seriously that the President and his wife finally went by themselves, with the fatal result with which the whole world is familiar. Undoubtedly, if General Eckert had been in the box with the presidential party there would not have been very much left of John Wilkes Booth after he had encountered the big fist of the man whom Lincoln always called "Tom," and in whose prowess he always had unbounded confidence.

General Eckert was born in St. Clairsville, Belmont County, O., April 23, 1825, and served as assistant secretary of War from July 27, 1866, until February 28, 1867. (Wm. Dean Howells, the distinguished novelist, and Charles W. Price, editor-in-chief of the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, were born in the same eastern Ohio county.) General Eckert's entrance into the telegraph business was as a lineman and he was taught to operate by the late Samuel H. Kauffmann, for many years one of the principal owners of the Washington *Star*. His subsequent career is so familiar that it is unnecessary to dwell upon it. The remaining three, all of whom were cipher operators for Mr. Lincoln, are still living.

David Homer Bates is especially active and one of the most wonderfully preserved men for his years that can be found anywhere in the country. He resides in New York, where he also transacts business every day of his life, Sundays excepted.

He was born in Steubenville, July 3, 1843, and learned to telegraph in 1859. He was one of the four men who entered the Military Telegraph Service early in the first days of the conflict between the North and the South, placing his services at the disposal of the War Department seven days after Fort Sumpter was fired upon. After



Telegraph Staff of the War Department During the Civil War.

A Notable Group of War-Time Telegraphers.—From left to right—General Thomas Thompson Eckert, chief; David Homer Bates, manager and cipher operator; Charles Almerin Tinker, cipher operator; Albert Brown Chandler, cashier and cipher operator.

the War he was appointed manager of the Consolidated American & Western Union Telegraph offices at Washington.

To him and his comrades, Messrs. Tinker and two others, was assigned the duty of preparing and translating cipher despatches passing between the Government at Washington and the commanders in the field. He was barely of age when he was appointed assistant manager of the United States Military Telegraph — Department of the Potomac. On January 1, 1884, he became president of the Baltimore & Ohio Telegraph Company, a position he held until the Western Union Telegraph Company absorbed Mr. Garrett's telegraph lines. Mr. Bates then engaged in other pursuits and was prominent in the service of the Gamewell Fire Alarm Telegraph Company, of which he became vice-president. He also became conspicuous in managing the Bradstreet Company, serving as general eastern manager and having control of all the offices east of Illinois.

During all the years that the agitation has been going on in Congress looking to the securing of pensions for disabled operators who served with him in the United States Telegraph Corps, he has been a strong worker and has accomplished at least the granting of pensions by Mr. Carnegie, who has valiantly taken the place of his government in the paying over to all who need the money, a monthly pension equal to what they would receive if the Government did its duty to a body of men of whom Lincoln, Grant, Sherman, Sheridan and scores of commanding officers have said that they composed one of the important if not the most important branches of the military service.

The failure of Congress to do the military telegraphers justice is a mystery as deep and as dark as the vague, inelastic and contradictory laws of the Medes and Persians.

Albert B. Chandler divides his time between New York and West Randolph, Vt., where he owns and operates an extensive farm. He is the chairman of the Board of Directors of the Postal Telegraph-Cable Company. Mr. Chandler was born in West Randolph, Vt., August 20, 1840. He was connected with the United States Military Telegraph service from 1863 to 1866. After the war he was with General Eckert as an executive officer in the Western Union Telegraph service at New York and later was president of the Atlantic & Pacific Telegraph Company.

In 1881 the Western Union Telegraph Company, the American Union Telegraph Company—of which General Eckert had been elected President—and the Atlantic & Pacific Telegraph Company were merged, Mr. Chandler entering the service of one of the electric light companies, in competition with the Edison Company.

With the advent of John W. Mackay in the telegraph and cable field, Mr. Chandler became his strongest friend and ally until his extremely valuable services led to his being chosen president of the Postal Telegraph-Cable Company. In recent years he has served with distinction as chairman of the Board of Directors.

Charles Almerin Tinker has retired from the telegraph business and is now living a retired life. He was present at the annual dinner of the Magnetic Club on April 16, 1913, looking almost as young as he did ten years ago. Mr. Tinker was born in Chelsea, Orange County, Vt., January 8, 1838. He learned telegraphy in the office of the Vermont & Boston Telegraph Company and was a Bain operator at Northfield, Vt., in the summer of 1862, going to Boston in 1855, where he learned Morse and became an operator for the Cape Cod Telegraph Company in the Merchant's Exchange. He was soon drawn in the direction of Chicago, however, and worked as an operator in the office of the Illinois & Mississippi Telegraph Company. He went to Pekin, Ill., for a short time and returned to Chicago and went into the lumber business as a bookkeeper. He soon returned to the telegraph business, however, and in October, 1861, entered the United States Military Telegraph service. He was with the Army of the Potomac until McClellan's retreat from in front of Richmond. He was then recalled and appointed to the position of chief operator and cipher operator at the War Department, succeeding later to the management of the office, in which position he remained and attended to the final closing up of the affairs of the military telegraph under the direction of General Eckert and General Rawlins, Secretary of War. After the war he was successively manager of the Western Union in Washington; superintendent of telegraph of the Central Vermont Railroad Company, with headquarters at St. Albans; general superintendent of the Central & Pacific Divisions of the Atlantic & Pacific; and superintendent of telegraph of the Baltimore & Ohio Railroad Company; incorporator with Jay Gould and D. H. Bates of the American Union Telegraph Company and general superintendent of the Eastern Division of the Western Union Telegraph Company. Having retired from business altogether, he lives a quiet life in Brooklyn. He devotes himself to the natural pursuits of a man who reads extensively, and his present occupations, though literary in character, enable him to substitute the pleasures of the library as a complete and satisfactory exchange for the many activities which engaged his attention for many years and which began when he was a boy of fourteen.

Navy Wireless Station at Balboa.

The radio station at Balboa, Canal Zone, operated by the United States Navy Department, has opened for commercial business, transmitting messages to ships on the Pacific side of the Isthmus at the rate of eight cents a word. The range of delivery is about 200 miles in the daytime, and up to approximately 1,000 miles at night, when the atmospheric conditions are favorable. The station has direct connection with the Panama Railroad telegraph and telephone lines.

The two-kilowatt plant, with which the station is equipped, was made by the Wireless Improvement Company, of New York City. It uses a "break system," which allows a receiving station to break in on the transmission of a message, in order to ask for repetition or explanation. In the intervals when the sending key is released between dots and dashes it opens a relay in the receiving circuit and the operator is able to hear calls from other stations. Electricity is received from the nearby power plant of the Isthmian Canal Commission and transformed by the apparatus to a high-frequency oscillating current, and as such is radiated by the antenna at 12,500 volts. The antenna is attached at one end to the smokestack of the power plant and at the other to a steel frame tower about 110 feet high. Four operators are employed at the station, working on four-hour shifts day and night.

Chicago Section, Electric Vehicle Association of America.

The weekly meeting of the Chicago Section, Electric Vehicle Association of America, was held on June 24 at the La Salle Hotel, with H. E. Neisz presiding. An informal discussion on charging equipment was held, the discussion being led by J. P. Loyns, of the Electric Products Company, of Cleveland, O. This company has recently brought out an automatic rectifier for battery charging which cuts off current when the battery is fully charged. The consensus of opinion of those present was that, due to the high cost of glass tubes and frequent renewals, some public garages were installing small motor-generator sets to take care of battery charging during the day.

Mr. Loyns was requested to prepare a paper on the equipments in question to be read before the annual convention of the Electric Vehicle Association of America in November.

Electricity in Book-Binding Plants.

The application of individual electric motors to bindery machinery has come to be accepted as standard practice because of the economy, flexibility and cleanliness of such system of drive. Power requirements of book-binding machinery and advantages of motor drive are discussed in this article. Operating data on several typical plants are also given.

The application of individual motors to book-binding machinery has come to be accepted as standard practice by binderies throughout the country, yet there seems to be a number of plants that still adhere to the old line-shaft drive with its attendant friction losses and disagreeable operating features.

The first cost of individual drive is commonly assumed to be in excess of the first cost for group drive but this is not always the most important consideration. In fact, an exhaustive test in one bindery showed that while the first cost of an installation of individual motors would be $10,500 as compared with $8,723 for group drive, the difference of $1,777 would be more than compensated for by the saving in friction losses. Tests showed that the no-load friction losses of group drive would be equal to $2,480 per year, while the losses chargeable to individual drive would be $690 per year, a difference of $1,790 per year in favor of individual drive which cost only $1,777 more than the group drive.

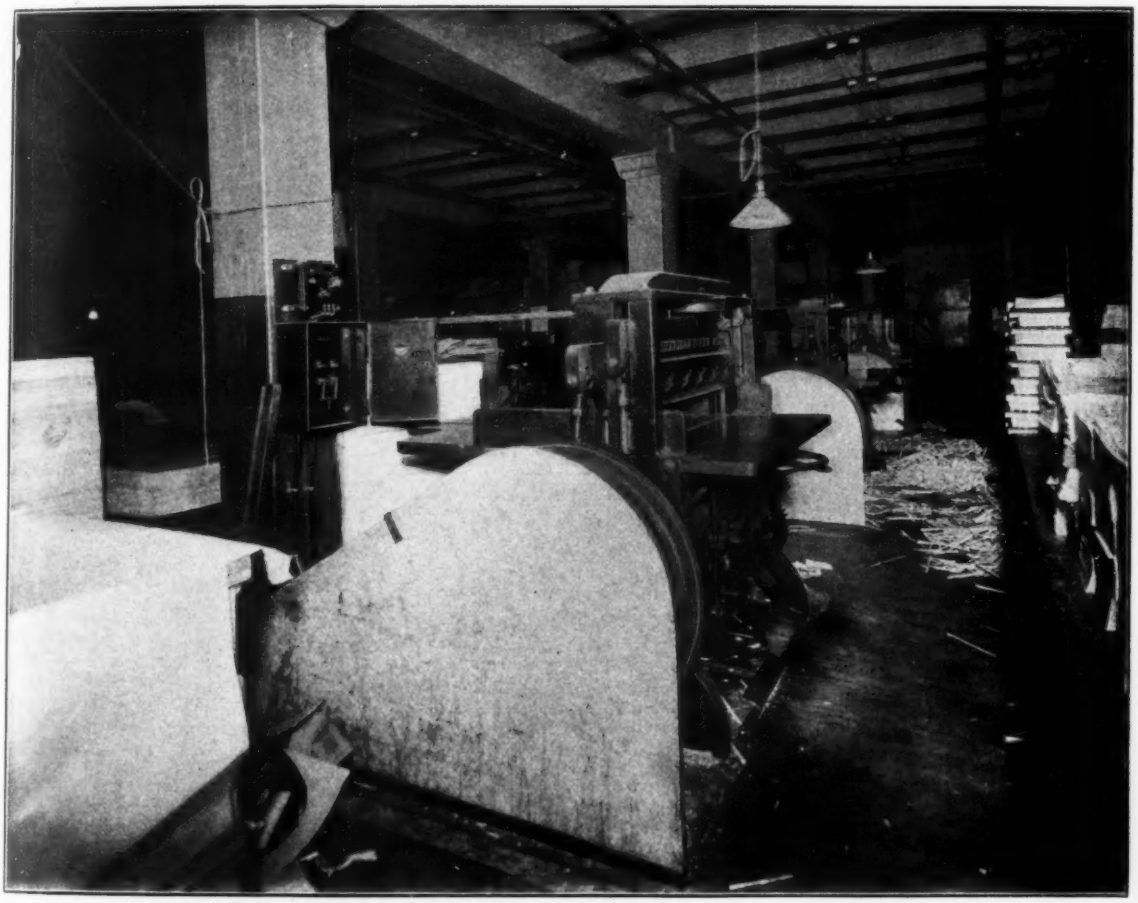


Fig. 1—Group of Paper Cutters in Bindery Driven by Individual Motors.

These figures indicate that if the proper motor is used for individual drive, the difference between the cost of individual and group drive is not large, if a new installation is considered. Instead of investing money in shafting and belting, it can be more economically invested in the purchase of electric motors for individual drive.

However, a careful analysis must be made in each case as local conditions must govern each installation. In cases where an old shop is completely equipped with line-shaft drive it might not pay to scrap all the overhead work already installed at once, the loss in production being too great, but whenever new machines are purchased, or whenever changes are made in the shop layout the transmission problems should be closely studied to determine the advantages of each type of drive from an economic point of view. In the majority of cases individual drive will show the greatest number of advantages.

Aside from the financial considerations of group and individual drive there are many general advantages that should make individual drive appeal particularly to managers of book-binding plants. Adaptability, space economy, cleanliness, speed control and reliability, all inherent advantages of motor drive, have an indirect bearing on final operating costs.

As all individually driven machines are independent of alinement with respect to countershafting, book-binding machinery may in consequence be arranged

to secure every advantage from natural lighting facilities, and, in addition, be so located as to obtain the most expeditious and efficient sequence of work. Almost every bindery manager has experienced at some time the difficulty of arranging his machines to conform to fixed lines of shafting, and often troublesome and power-wasting devices, such as bevel gears, have to be employed. These difficulties are, of course, obviated with electric power and further advantage can be taken of the flexibility of the system to change the position of a machine whenever an alteration of routine makes it advisable.

The substitution of electric drive for other forms of power invariably results in a cleaner, more sanitary and efficient shop. Such conditions, furthermore, react favorably for the general uplift of the employees, thus indirectly influencing increased and improved production. Electric drive also eliminates dirt-disturbing belts, oil-throwing shafting, and hangers found in mechanically driven plants—an ever-present source of damage to the finished or nearly finished product. The elimination of shafting, hangers and belts also greatly improves the lighting conditions.

Owing to the variety of work performed, book-binding machinery as a rule requires a certain degree of speed variation in order that, with a given equipment and force of operatives, the maximum of high grade production may be turned out. All necessary speed variations are most readily, economically and satisfactorily obtained with electric drive and control. Each machine is at all times under instant control, so that the entire attention of the operator may be devoted to the work in hand.

Reliability is of course of vital importance, particularly in plants binding magazines, etc. The reliability of central-station power is too well known to need further comment here. However, with individual motor drive in case of breakdown of a motor or machine it is not necessary to shut down the entire plant as is necessary with mechanical drive.

Selection of Motors.

In deciding upon the field winding of motors for driving book-binding machinery, the circumstances of the drive must be considered. A plain shunt motor is most suitable where it is desired to drive groups of machinery by means of shafts and belting, and in all cases where constant speed is required. For driving machines direct through spur or chain gearing, the motor should be compound wound so as to give a larger starting torque. To overcome the initial torque of the driven machine there are an endless variety of combinations between shunt and series windings which can be arranged, and it should be borne in mind that the greater the percentage of series turns, the larger will be the starting torque, whereas constancy of speed is more and more sacrificed as the series field is increased.

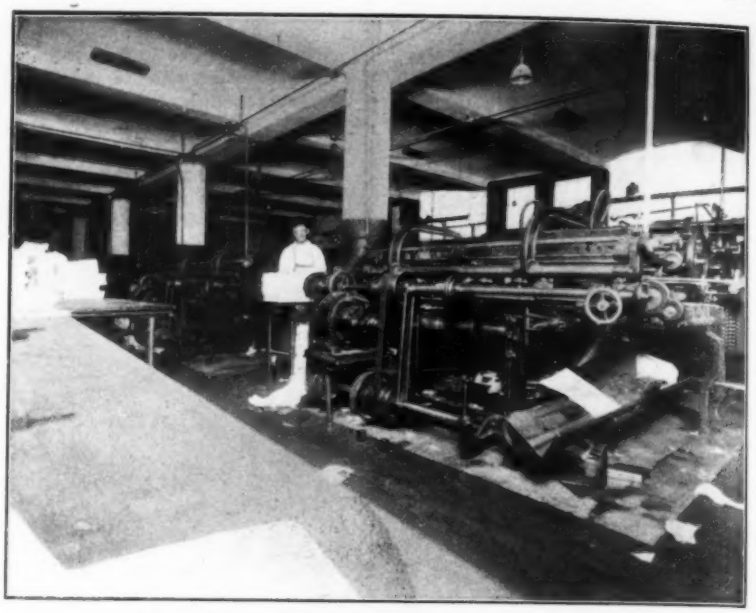


Fig. 2—Battery of Folders Driven by Individual Motors.

With proper compounding, a smaller size frame may be used than when the percentage for series turns is too small, because it is often the case with bindery machinery where there are heavy peaks in the load that the sparking limit is reached before the overheating limit, and it is necessary not only that the motor should be large enough to do its work without overheating, but also it must be large enough to take peak loads without sparking.

Interpoles are now largely used by manufacturers to get over this difficulty. The interpole machine is no more efficient than any other, but will allow of a greater overload being carried temporarily without its reaching the sparking limit. The use of interpoles, therefore, enables a smaller size frame of motor to be used in cases where the load varies so as to cause sparking, even though the average load is not more than the motor is designed to carry.

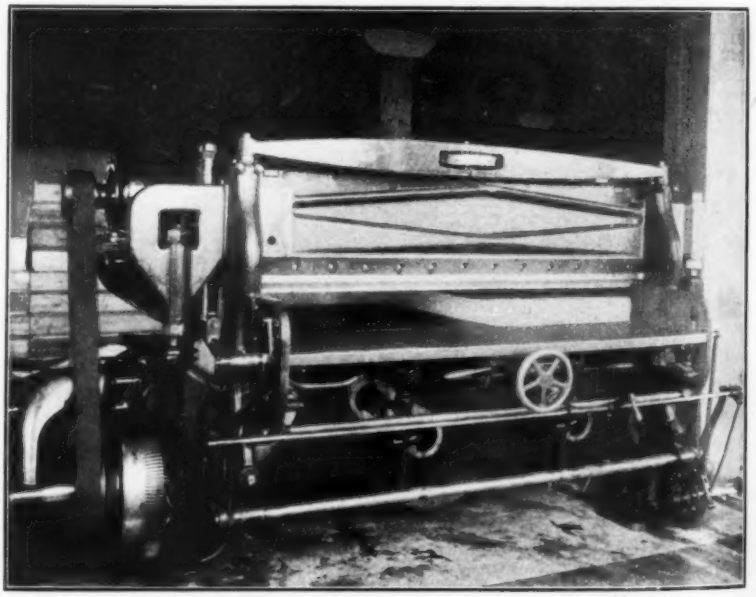


Fig. 3—Motor-Driven Paper Cutter.

The next point to consider is the speed,

Book Binding Data—Sheet No. 1

The term load-factor is used in these data in such a sense that a load-factor of 100 per cent represents the use for 24 hours every day of power corresponding to the rated capacity of the motors connected. An operating-time load-factor of 100 per cent represents the use of the rated capacity of the motors for the running hours per day specified for each installation.

Grady Book Binding Company, New York City. This plant does a jobbing business, having an average output of 4,000 books per 10-hour day.

Total connected horsepower, 17.5. Total number of motors installed, 5. Average kilowatt-hours per month, 1,052.

Kilowatt-hour consumption for 12 months:

Month.	Kilowatt-Hours.	Month.	Kilowatt-Hours.	Month.	Kilowatt-Hours.
January	885	May	1,102	September	1,072
February	1,084	June	959	October	1,046
March	1,186	July	963	November	1,037
April	1,265	August	935	December	1,150

Load-factor, 11 per cent; operating-time load-factor, 23 per cent.

The approximate electrical energy consumption per 1,000 books made is 10 kilowatt-hours.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is 240 volts, direct current.

No.	Horse-power.	Speed R. P. M.	Application.
1	3	1,200	Belted to a line shaft driving six small folding machines.
1	1	1,200	Belted to a line shaft driving six stitchers.
1	4	1,200	Belted to a line shaft driving one rounding and backing machine; one trimming machine; one 36-inch paper cutter; and one small roller.
1	2	1,700	Belted to one smasher.
1	7.5	1,200	Belted to a line shaft driving five embossing machines; one cardboard cutter; and one 48-inch Sheridan paper cutter.

Energy is supplied by the New York Edison Company.

Book binding plant located in New York City doing a high grade of work. Capacity of the plant is 5,000 books per day, although the output varies greatly. Operating time per week, 60 hours.

Total connected horsepower, 27.5. Total number of motors installed, 23. Average kilowatt-hours per month, 1,686.

Kilowatt-hour consumption for 12 months:

Month.	Kilowatt-Hours.	Month.	Kilowatt-Hours.	Month.	Kilowatt-Hours.
January	1,640	May	1,430	September	1,550
February	1,850	June	1,760	October	1,800
March	2,110	July	1,380	November	1,420
April	2,200	August	1,770	December	1,320

Load-factor, 12 per cent; operating-time load-factor, 23 per cent.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is 220 volts, direct current.

No.	Horse-power.	Speed R. P. M.	Application.
6	2	1,200	Each belted direct to a Dexter No. 121 Standard folder.
2	2	1,200	Each belted direct to a Seybold Machine Company 20th Century paper cutter.
1	1	1,200	Belted direct to a Sheridan gathering machine.
4	1	1,700	Each belted direct to a book pasting machine.
1	0.5	1,200	Belted direct to a round cornering machine.
1	5	1,200	Belted direct to a Seybold embosser.
8	0.125	940	Each direct-connected to a Monitor No. 2 wire stitcher.

Book binding company handling a uniform line of law books. Operating time per week varies.

Total connected horsepower, 16. Total number of motors installed, 10. Average kilowatt-hours per month, 1,120. Average kilowatt-hours per month per horsepower connected, 70.

Kilowatt-hour consumption for 12 months:

Month.	Kilowatt-Hours.	Month.	Kilowatt-Hours.	Month.	Kilowatt-Hours.
January	1,150	May	1,020	September	1,350
February	1,270	June	1,000	October	1,240
March	1,020	July	1,110	November	960
April	1,080	August	1,220	December	1,020

Load-factor, 13 per cent.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is 220 volts, direct current.

No.	Horse-power.	Speed R. P. M.	Application.
1	1	1,375	Belted direct to one embossing machine.
1	1.5	550	Belted direct to one embossing machine.
1	3	1,150	Belted direct to one grinding machine.
1	2	1,150	Belted direct to one Sheridan 44-inch cutting machine.
1	0.25	1,070	Belted direct to one Pearing machine.
1	7.5	825	Belted to line shaft driving eight sewing machines; two trimming machines; one Seybold paper cutter; two smashers; two stitchers; and one rotary board cutter.
1	0.125	1,600	Belted direct to one addressograph.
2	0.125	1,500	Each belted direct to one addressograph.
1	0.25	1,500	Belted direct to one graphotype.

Book Binding Data—Sheet No. 2.

Book binding plant handling the work of a large printing and publishing house. Operates 10 hours per week.

Total connected horsepower, 37. Total number of motors installed, 18. Average kilowatt-hours per month, 1,230. Kilowatt-hour consumption for 12 months:

Month.	Kilowatt-Hours.	Month.	Kilowatt-Hours.	Month.	Kilowatt-Hours.
January	1,223	May	1,096	September	1,286
February	1,053	June	1,019	October	1,381
March	1,297	July	1,188	November	1,261
April	1,112	August	1,430	December	1,420

Load-factor, 6 per cent; operating-time load-factor, 13 per cent.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is 220 volts direct current.

No.	Horse-power.	Speed R. P. M.	Application.
1	4	1,700	Belted to a line shaft driving one rounding and backing machine; and two trimming machines.
1	5	1,200	Belted to a line shaft driving six embossing machines; and two card-board cutters.
2	1	1,200	Each belted direct to one Sheridan gathering machine.
4	1	1,700	Each belted direct to one book-pasting machine.
1	3	1,250	Belted direct to one Chambers Brothers 48-inch by 68-inch folding machine.
1	2	1,100	Belted direct to one Chambers Brothers 44-inch by 62-inch folding machine.
1	0.25	940	Belted direct to one book-punching machine.
1	2	1,100	Belted direct to one Seybold 20th Century paper cutter.
1	2	1,200	Belted direct to one Sheridan (New Model) 34-inch paper cutter.
1	2	1,150	Belted direct to one Sheridan 44-inch paper cutter.
1	0.25	1,070	Belted direct to one Pearing machine.
1	2	1,700	Belted direct to one smasher.
1	1	1,200	Belted to line shaft driving six wire stitchers.
1	7.5	1,200	Driving elevator mechanism.

Bindery doing small jobbing business. Operates 10 hours per day.

Total connected horsepower, 15.5. Total number of motors installed, 5. Average kilowatt-hours per month, 941. Kilowatt-hour consumption for 12 months:

Month.	Kilowatt-Hours.	Month.	Kilowatt-Hours.	Month.	Kilowatt-Hours.
January	730	May	1,080	September	950
February	900	June	950	October	1,030
March	810	July	950	November	720
April	1,080	August	980	December	1,110

Load-factor, 11 per cent; operating-time load-factor, 23 per cent.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycles, 220 volts.

No.	Horse-power.	Speed R. P. M.	Application.
1	3	1,800	Belted direct to one Sheridan 36-inch paper cutter.
1	3	1,200	Belted direct to one Seybold 20th Century 36-inch paper cutter.
1	1	1,300	Belted direct to one Chambers Brothers folding machine.
1	7.5	1,650	Belted to line shaft driving two wire stitchers; one paper perforator; one paper punch; one Singer stub sewing machine; one ruling machine; and one knife sharpener.
1	1	1,200	Belted direct to one 32-inch by 44-inch folding machine.

Book binding plant operated by a separate company in connection with a printing and publishing plant, publishing about 92 periodicals per month. The plant operates in two shifts, aggregating 96 hours per week.

Total connected horsepower, 12.5. Total number of motors installed, 13. Average kilowatt-hours per month, 935. Kilowatt-hour consumption for 12 months:

Month.	Kilowatt-Hours.	Month.	Kilowatt-Hours.	Month.	Kilowatt-Hours.
January	1,174	May	560	September	921
February	1,194	June	646	October	941
March	1,240	July	548	November	1,040
April	1,100	August	662	December	1,174

Load-factor 14 per cent; operating-time load-factor, 18 per cent.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is 220 volts, direct current.

No.	Horse-power.	Speed R. P. M.	Application.
1	2	1,100	Belted direct to a Seybold 34-inch paper cutter.
1	2	1,200	Belted direct to Sheridan 34-inch (New Model) paper cutter.
6	0.125	940	Each direct-connected to a Monitor No. 2 wire stitcher.
1	2.5	1,100	Belted direct to one Chambers Brothers 43-inch by 45-inch folder.
1	2	1,100	Belted direct to one Chambers Brothers 44-inch by 62-inch folder.
1	3	1,250	Belted direct to one Chambers Brothers 48-inch by 68-inch folder.
1	2	1,200	Belted direct to one Chambers Brothers 48-inch by 62-inch folder.
1	0.25	940	Belted direct to one book punching machine.

and this is most important, because price depends very largely upon the speed, and a compromise has often to be struck between questions of economy in first

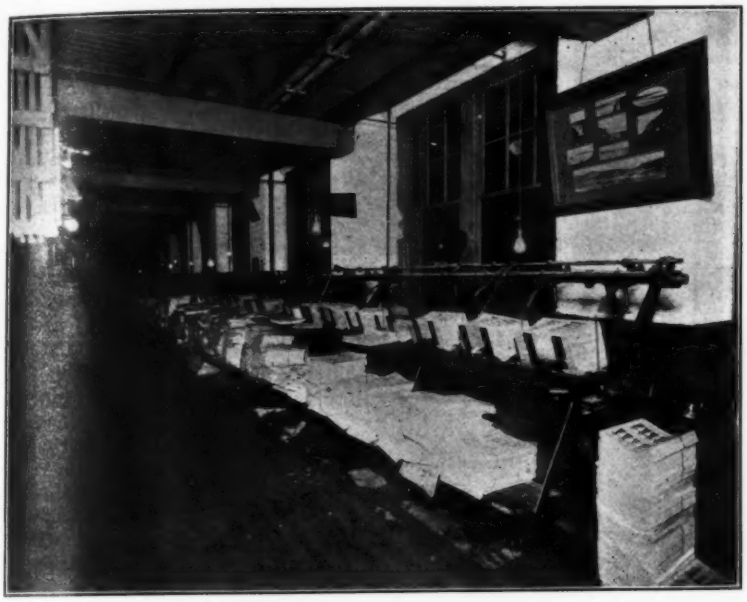


Fig. 4—Gathering Machine in Bindery.

cost and running cost. In selecting a suitable speed, it should be remembered that the slower it is the longer will be the life of the motor, also that a larger reduction than 5 or 6 to 1 is inadvisable in a single belt or gear.

Fig. 5—Group of Motor-Driven Stitchers.

Alternating-current motors give equal satisfaction for bindery drive. Where a constant speed is required, the squirrel-cage induction motor is recommended. For variable-speed machines the motors should be provided with slip rings by which resistance is introduced into the rotor for decreasing the speed.

The accompanying table gives the sizes of motors recommended for various book-binding machinery.

A brief description of a typical book-binding plant will convey a better idea of the service motors are called upon to perform in this industry. In a plant, located in the west, a complete installation of individual motors has recently replaced an antiquated steam-engine drive. Under the old conditions power for the various machines was obtained from a vertical shaft driven by a Corliss engine in the basement. This shaft passed through the various floors and to it was belted the horizontal shafting. The ceilings were obstructed with shafts and belts which become an increasing annoyance owing to the loss of production from damage by oil and dirt. The breaking of belts and consequent delays, and the lack of flexibility in obtaining variable speeds resulted in the adoption of electric drive.

Machine.	Horsepower Required.
Lathan Monitor stitcher	0.5
Hickok ruling machine	0.25
Hickok knife grinder	1
Hickok round-corner machine	0.25
Morrison wire stitcher No. 2	0.125
Morrison wire stitcher No. 4	0.25
Morrison wire stitcher No. 12	0.5
Dexter folders, No. 121, Standard	2
Dexter folders, No. 122, Special	3
Dexter folders, No. 125	2
Dexter folders, No. 131, quadruple	2
Dexter folders, No. 132, quadruple	3
Dexter folders, No. 44	0.75
Dexter folders, No. 80	1
Dexter folders, No. 93	2
Dexter folders No. 148	3
Sheridan die presses, 44 by 22 in	2
Sheridan die presses, 33 by 18 in	1
Sheridan rotary shears	0.75
Sheridan arch embosser	1
Sheridan one-inch horizontal covering machines	2
Sheridan case maker	2
Sheridan gathering machine	1
Sheridan hand-clamp book trimmer	1
Sheridan automatic book trimmer	1
Sheridan new mill cutters	3 to 5
Sheridan 34-inch perfection cutter	1
Sheridan hand-clamp cutter	1 to 2
Sheridan automatic paper cutter, 36-inch	1
Sheridan automatic paper cutter, 50-inch	2
Sheridan automatic paper cutter, 65-inch	3
Sheridan automatic paper cutter, 75-inch	5
Book pasting machine	1
Book trimmer	3
Book smasher	3
Book sewing machine	1.5
Book embossing machine	3 to 10
Book stitcher	0.25
Book punching machine	0.25
Book paging machine	0.125
Board cutter	1
Profiling machine	1
Gold-dust machine	0.25
Book stamp	2 to 5
Ruling machine	0.25
Round cornering machine	0.5
Book gumming machine	0.125
Prouty perfecting press, 12 by 18	1
44-inch Oswego cutter	2
36-inch Oswego cutter	1
48-inch Sanborn cutter	2
Seybold embosser	5
Cardboard splitting machine	1
Victory embossing machine	1
Ink mills	1 to 7.5
Blackhall embossing machines	0.5
48-inch Brown folder	2

A battery of six folding machines with mechanical feeders, installed in this plant, is shown in Fig. 2. The motors for these folders are started and stopped by means of two-button push buttons, six of which are located at different points about each machine, so that the attendant may stop or start the machine from any position. These push buttons control an automatic starter for the motor. A field rheostat is also installed, and by setting this the foreman in charge can arrange for any given speed, so that the attendant need only operate the controlling buttons. The automatic starter, field rheostat,

main-line switch and fuses are mounted on a slate panel set up within the framework of the folder, but not visible in the cut.

Fig. 3 shows a Seybold paper cutter driven by a two-horsepower motor. The motor for this machine is started and stopped about once in every ten minutes. The apparatus is self-explanatory.

The makers of the pasting machine used in this plant did not believe that this piece of apparatus could be operated by a motor because of the fact that it had to be stopped quickly and would require an unusually strong man on the brake. A motor, an automatic starter, and a dynamic brake made this machine manageable by a girl attendant, who needs only to push the control button.

A rounder and backer is a slow moving machine used for rounding the back of a book. As ordinarily equipped, the electrical application consists of a hand operated rheostat, a motor, and a foot switch to open the holding coil of the rheostat when the brake is worked. When it is desired to reverse the machine, the flywheel is pulled back by hand. In this plant an arrangement was worked out by means of which considerable time is saved both in the frequent use of the hand-starting rheostat and in the cumbersome method of pulling back the flywheel by hand. The reversing switch, when moved fom the vertical, will cause the automatic starters to operate, thereby energizing the motor. The foot brake is made in the form of a lever and is so connected to a contactor that when the lever is pressed down, the circuit will open at the time that attendant's weight comes on the flywheel; the operation being the same when the machine is reversed. The attendant keeps his foot on the brake most of the time. A field rheostat enables the foreman to set the speed for the output desired; this may vary from 30 to 90 books an hour according to size, shape and weight of material.

A very interesting machine is that which, from its function, is known as the gatherer. A book is usually made up of sections which will ordinarily vary in number from 25 to 60. It is the purpose of this machine to gather these sections in proper order so that when delivered the pages read consecutively. The starter for this gatherer is mounted on the far wall, as shown in Fig. 4, the operating buttons being located on the machine at the receiving end.

About 35 motors varying in size from 0.25 to 5 horsepower are now installed in this plant. Small motors of one horsepower or less, operating machines which require practically no starting torque, are compounded and thrown across the line. These motors are started by three-way snap switches which give full field before the armature is switched onto the line; this arrangement obviating considerable trouble from the blowing of fuses.

Nearly all motors larger than one horsepower are provided with automatic starting devices, the result of which is an increase of 15 per cent in the output for a given number of men and machines. This increase in production has not been due alone to the speeding up of various machines, but to the time saved through not having the employees concerned with starting the motors.

Commercial Practice
Management, Rates, New Business

Conditions at Rome, Ga.

The Rome (Ga.) Light & Power Company enjoys almost unique service in the way of preparation against possible accidents to its own plant. Some time ago it arranged for current from the waterpower plant of the Tennessee Power Company on Ocoee River, while more recently it has made connections with the Georgia Power Company, which recently opened a waterpower station not far from Rome. As these two plants have "dry seasons" which do not coincide, it is practically certain that the Rome station will not be compelled to rely on it own steam plant, which is kept ready to operate at moment's notice, however, and is under contract to supply current to the water power companies in case of need. The low rate which the central station is able to quote its customers on electric service has resulted in a large addition to the power load, the Anchor Duck Manufacturing Company, one of the largest cotton mills in that section, having only recently contracted for service from the Rome company.

THE UNIT WELL SYSTEM—AN EXPERIMENTAL WATER SUBSTATION AND DEEP WELL AT ROCKFORD, ILL.

By G. G. Crane.

In explanation of what is meant by the "Unit Well System" it might be stated that this plan contemplates the installation of series of wells, located in different sections of the city, pumping directly into the mains or stand-pipe of comparatively small capacity.

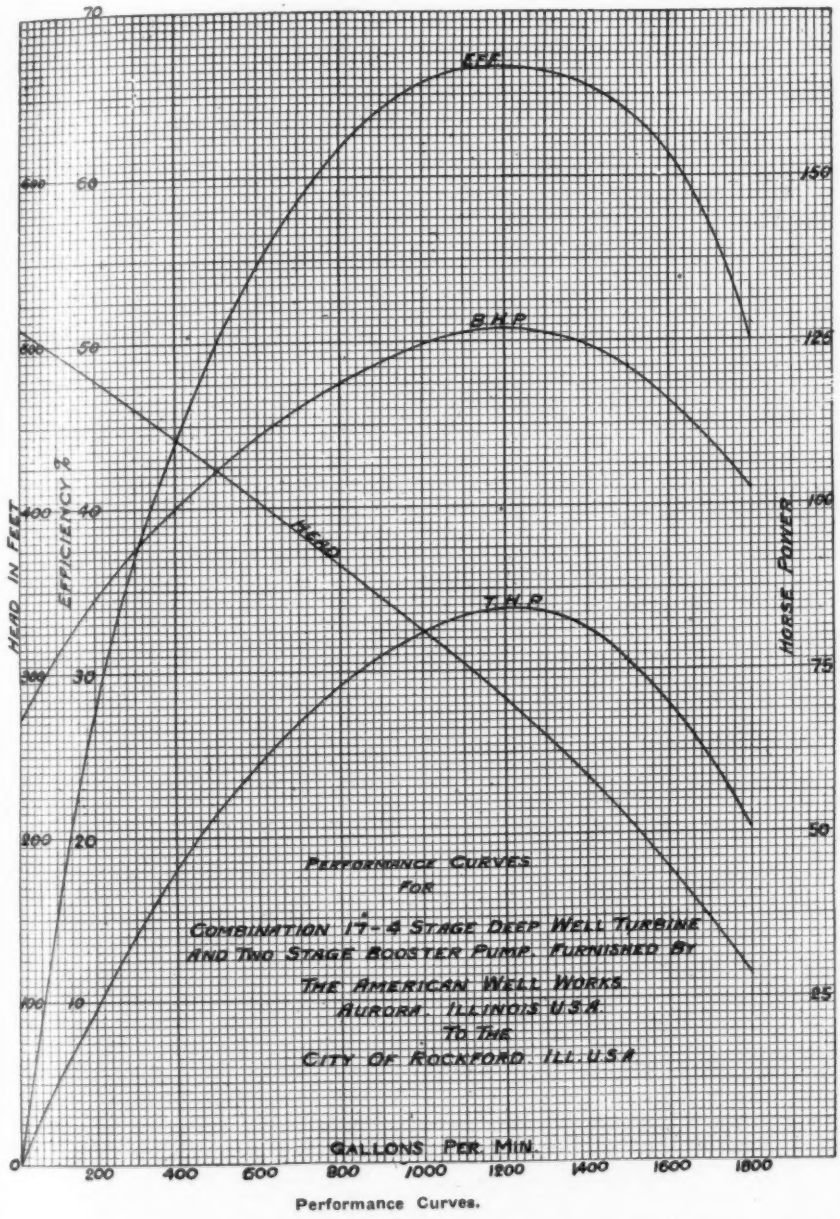
This plan renders unnecessary the installation of pipes and mains of large capacity and high pressure, which would be necessary if all of the water supply, for the city mains, came from one point.

In the year 1910 the City of Rockford, Ill., employed a special commission, composed of John W. Alvord, Dabney H. Maury and Daniel W. Mead to report on the enlargement and extension of the municipal water-supply system. Pursuant to the report and recommendations of this commission their project "No. 3" was selected, for experiment.

"This project contemplates securing additional water, from supplemental wells to be sunk into the Potsdam sandstone at points widely distributed throughout the city and generally located near the outer ends of the larger feeder mains. In each well there would be a centrifugal deep-well pump, direct-connected to an electric motor at the surface. The water lifted by the deep-well pump would be pumped into the mains by a direct-connected motor-driven pump at the surface, while additional pressure for fires would be furnished by another direct-connected motor-driven pump, which could be started by throwing a switch and without opening or closing a valve. A generating plant at the pumping station would ordinarily supply the power to operate the motors, but there would also be an emergency connection with the wires of the local electric power company. Several arrangements of pumps for this service would be possible and detailed investigation may show that some other arrangement than that above suggested would be advisable."

The contract for drilling this well was awarded to an Eastern drilling company. The work of drilling this well was com-

menced in May, 1912. This first company continued work until August but failed to go deeper than 150 feet with 18-inch casing and had not complied with the terms of the contract. Their contract was annulled and the same was re-awarded to the Cater Contracting Company, of Chicago, who started work about September 20, 1912, completing drilling in the early part of February, 1913.



Performance Curves.

Description of Well.

The contract called for an 18-inch standard iron casing, one-half inch thick, for the first 250 feet; 12-inch casing for the next 150 feet and balance of bore to be 12-inches diameter, to a total depth of 1,500 feet. The first 150 feet was in fine sand, and the next 100 feet was in concrete gravel. It was necessary to use a rotary drill in order to land this 18-inch casing on the top of the magnesium limestone. It was in trying to drive the 18-inch casing that the first company failed. The contract price for this well was about $9,000, and the actual cost to the driller was about $11,000.

The St. Peter Strata was cased and packed off. The water bearing stratas, supplying this well, are located between 920 and 1,500 feet down.

Instructions to Bidders on Equipment.

No. 1—One combination deep-well and pressure pump, mounted on the same shaft, driven by one motor; to have pressure-regulating device that will start and stop motor specified, at a variation of 10-pounds pressure.

The bidder was to state provision to be made in connection with the deep-well pump, in the form of vacuum and pressure gauges, so as to determine the total head the pump would be operating under, static, friction and velocity heads included, and one gauge to determine level of water in the well. For pressure pump, one direct-reading pressure gauge and one Bristol recording pressure gauge, with 24-hour chart.

This contract was awarded upon the merits of the following points: Cost; Time of Delivery; Efficiency of Operation; Guarantee of Maintenance Cost; and Retention of Operating Efficiency."

The contract was awarded to the American Well Works of Aurora, Ill., on "Project No. 1," which called for a combination deep-well and pressure pump, to be driven by one electrical motor. This company furnished a 17-inch six-stage combination deep-well and pressure pump, being a four-stage turbine type of pump located 108 feet in the well, with a two-stage centrifugal type of pump at the top of the well, as shown in the accompanying view, with the guaranteed overall operating efficiency of 59.5 per cent. But, on the several tests run after this equipment was installed, it proved to have an overall efficiency of 65.5 per cent, delivering 1,380 gallons of water per minute against a total head of 237.57 feet. The following is a facsimile of the last test made.

Capacity—1,380 gallons per minute. Discharge pressure 61.5 pounds equal to.....142 feet
Static Head to center of pressure Gauge..... 95.57 feet

Total head of..237.57 feet
Theoretical horsepower would be 82.1.
Meter reading ahead of transformers, 116 kilowatts.
90 per cent efficiency motor — 93.39 kilowatts delivered to shaft of pump.
Efficiency of pump, 65.5 per cent.

During a period of several days this pump was run, discharging its water through a five-inch fire hydrant, in order to clear the well of sand; this pump delivered water at the rate of two and one-half million gallons per 24 hours, with a discharge pressure of about 25 pounds. As the City has a direct pumping system it has not been practical to operate this well longer than 12 hours per day. Its average output, at 65 pounds pressure, for 12-hour operation has been 960,000 gallons, consuming 1,400 kilowatt-hours at one and a quarter cents per kilowatt-hour.

The cost of the equipment was approx-

imately $4,740, including pumps, motor and automatic starting apparatus. Power is purchased from Rockford Electric Company and is delivered as 4,000-volt, 60-cycle, three-phase alternating current, metered on the primary side. After entering the station it is dropped down to 440 volts at which it enters the motor. The automatic starting apparatus was furnished by the Cutler-Hammer company, and is operated by variations of pressure at the main. The method of securing a steady operation of this equipment is by the use of a 24-gallon pressure tank, which is inserted between the automatic gauge and the main. The connection between the main and the pressure tank is through a valve, with about one-thirty-second inch opening which takes a sufficient variation in pressure to either start or stop the motor.

The oiling system is being built at this time and consists of a filter tank, from which the oil passes into a general reservoir equipment, with four positive pumps, driven by a small one-eighth horsepower, 440-volt alternating-current motor, which takes its current directly from the motor leads and operates simultaneously with the main motor.

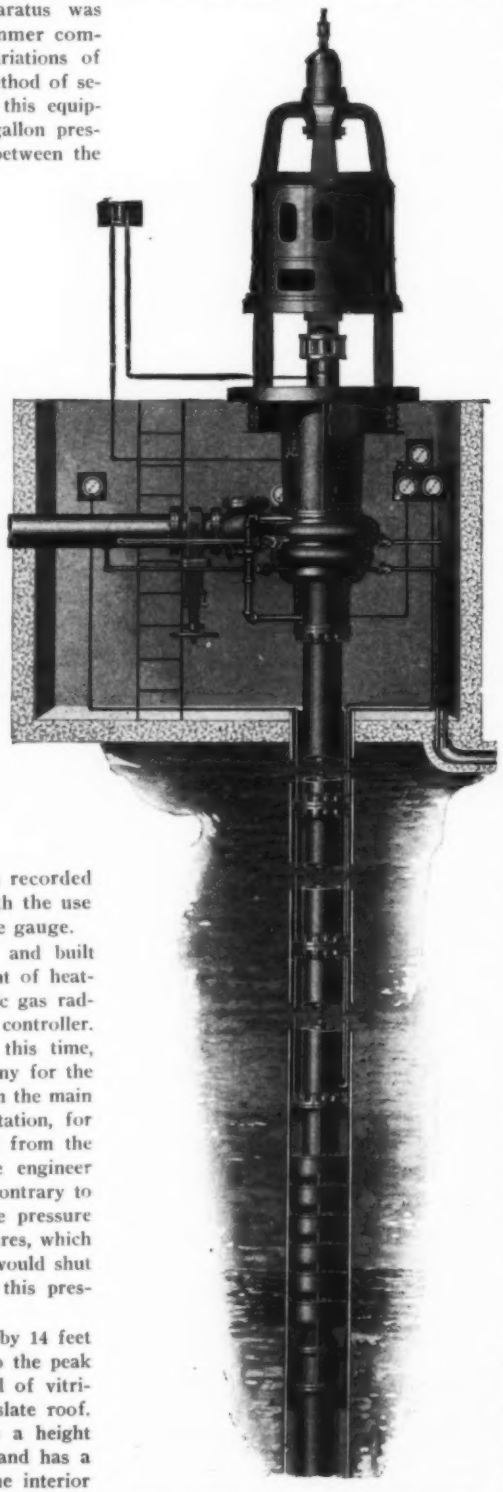
All the water pumped by this equipment passes through an eight-inch Worthington current meter. The incoming current is recorded by a watt-hour meter and with the use of a Bristol recording pressure gauge.

The building was designed and built as small as possible, on account of heating the same with an automatic gas radiator, which has a thermostat controller.

The city is negotiating, at this time, with the local telephone company for the lease of a pair of wires between the main pumping station and this substation, for the purpose of remote control from the main plant, in order that the engineer may operate this well at will, contrary to the automatic operation, as the pressure is raised to 85 pounds during fires, which with the automatic equipment would shut the substation down with but this pressure control.

The building is 19 feet long by 14 feet wide and about 18 feet high to the peak of the gable. It is constructed of vitrified paving blocks and has a slate roof. The interior is wainscoted, to a height of seven feet, with white tile and has a white tile floor; the rest of the interior is plastered. It is equipped with a set of ventilators, leading the cold air in at the bottom, then passing through the machinery and discharging out through the roof.

The building is equipped with a five-ton trolley crane, by the use of which the entire equipment may be removed from the well in about four hours. It is the intention not to man this station but to have its operation absolutely automatic with the exception of a man to visit it once a day, to take the meter readings, also to keep the substation clean. It may prove later, after having more experiments with this unit well, to be advisable to construct a standpipe or elevated tank at this location, in order to secure a flexible operation. As this pump is delivering, while it is in operation, almost one-half more water than it was designed to do, it will furnish nearly two-thirds of the water used in the City of Rockford at this time.



Pumping Unit Installed at Rockford, Ill.

Co-Operation of Government with German Central-Station Company.

The growing practice of co-operation between private enterprise and municipal or communal authorities in lighting and power undertakings in Germany is now proposed to be extended by the conversion of the Hamburg electricity works into a concern to be jointly owned by the existing company and the State of Hamburg. At present the company, which has a capital of $5,000,000, does not possess an exclusive monopoly of the business, and it is not intended to confer such a privilege upon it in the future, but permission is to be granted for an extension of the supply throughout the whole of the State, thus including a number of suburbs which are not now furnished with light and power. The Hamburg Senate proposes to subscribe for $2,500,000 preferred stock, in order to assist in the development of the system and to have a large interest in the company. According to the existing agreement between the Senate and the company, the former receives a share of 15.2 per cent of the gross receipts, in addition to one-fourth of the surplus after 6 per cent has been paid on the common stock, and one-half of the surplus remaining after the dividend amounts to 8 per cent. In future the State is first to receive 5 per cent on the preferred stock, and one-half of the surplus after the dividend on the common stock is 6 per cent, while the other half is to be distributed as a super-dividend on the entire capital.

Free Electric Irons at St. Joseph, Mo.

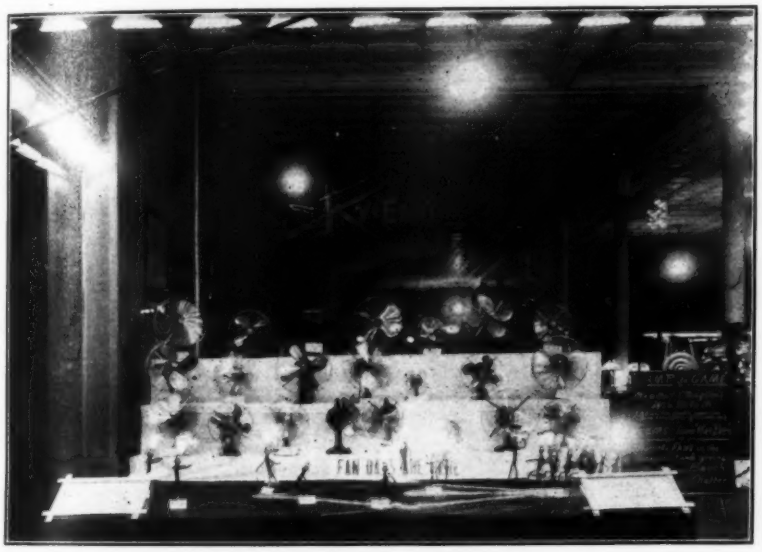
The St. Joseph (Mo.) Light, Heat & Power Company is offering free electric irons to new customers. The offer, however, applies only in cases where old houses have been wired for service. The irons have a retail value of $3.50 This offer, it is said, has been the means of securing many new customers.

Interesting Window Display.

A lamp and fan window installed by the Kentucky Electric Company, of Louisville, Ky., in its handsome new building near the heart of the retail business district, is just now arousing no end of enthusiasm among the "fans" of the Kentucky metropolis.

Judging from the size of the crowds which are reported to be attracted by the exhibit, a heavy percentage of Louisville's population must be recorded among the baseball cranks.

The window is laid out to represent a baseball diamond with a team of Mazda lamps defeating a nine composed of metallized-filament Gems. No detail has been overlooked in the construction of the display.



Window of Kentucky Electric Company.

The actual playing of the last half of the ninth inning is carried out with the Gems at the bat. Descriptive placards relate the results of the game up to this point and show that the Gems have been so sadly walloped that the Mazdas are forced to concede them the retirement of seven men instead of three before they will consent to play the last half inning of the game.

The players are represented by "men" ingeniously made out of duplex wire. Sixty-watt Mazdas are used as heads in one instance and sixty-watt Gems in the other. The Mazda team is provided with blue caps while the competitors wear red. The umpire, a frosted lamp, is the only "man" who remains lighted during the game. The plays are effected by the use of a 13-point flasher which is concealed beneath the platform used as a diamond.

In the course of the game brilliant field work is done by the Mazdas and all men on the team are brought into action one or more times during the half inning. One of the most ingenious stunts is the "fanning" of one Gem player. The grandstand is constructed the full length of the diamond and on this are displayed about a score of electric fans of various types. These fans are all attached to the flasher and made to show their enthusiasm by revolving for a short period when the more brilliant plays are made. On the retirement of the last man about half of the fans get into action, waving paper handkerchiefs to demonstrate their delight.

Local flavor is injected into the display by giving the Mazda players the names of members of the Louisville baseball team. Each Mazda is named after a corresponding player in the local club. The Gems are referred to as the "Has-Been" team. At the same time the electric fans have been named. Many prominent local citizens who never fail to appear at the ball park when the Louisville team is at home are found—by means of small placards attached to the electric fans—in the crowd of rooters for the Mazdas.

The Kentucky Electric Company issued a "KY-EL-CO Extra" on the game. It is in the form of a miniature newspaper page gotten up as a sporting edition and describing in detail the play which can be witnessed in the window. The little sheet contains advertising for the company and is illustrated with cuts of fans and lamps. These are distributed by the company at the fan and lamp counters in its display rooms.

Honolula Electric Rates Reduced.

Following the reorganization of the Hawaiian Electric Company, a reduction of rates amounting to fifteen and two-thirds per cent has been announced at Honolula, Hawaii.

Reduced Rates in San Francisco.

The Lighting Rates Committee of the board of supervisors of San Francisco has recommended that the ordinance establishing rates for electric current for the next year shall embody a reduction in the rate for lighting in residences and apartment houses from eight cents a kilowatt-hour to six cents a kilowatt-hour. It is estimated that this would mean a reduction of $250,000 in revenue to electric companies of the city based on the business of the present year. The Committee also recommends a reduction in the minimum charge for electric current from $1 to 75 cents a month. In addition the committee has reported that the present gas rate of 75 cents a thousand cubic feet should remain in force.

Power for Coal Mines.

The Trinidad Electric Transmission Railway & Gas Company, operating power plants and local interurban street car lines in Colorado, closed a contract for furnishing power to five of the largest coal mining properties in northern New Mexico owned by St. Louis, Rocky Mountain & Pacific Railroad.

The contracts necessitate the expenditure for new transmission lines of $100,000 and means connecting of Southern Colorado and New Mexico in power distribution system, one of the largest in this part of the country. This makes 50 coal mines in this section that are now purchasing power from Trinidad.

Boston to Have Great White Way.

That section of Boston's beautiful thoroughfare, Huntington Avenue, which extends from Copley Square to Massachusetts Avenue, is to be transformed into a great white way. The Huntington Avenue Improvement Association is the responsible party and the plan is to replace the brilliant lights that illumined the avenue during the Electrical Show last September. However, the lights will be white rather than in the colors of that occasion. It is understood that merchants and property owners of Boston have come to see the importance of adequate street lighting.

An Electric Truck for Hauling Poles.

The Philadelphia Electric Company has adapted the electric truck to a new use—hauling poles. This innovation not only has meant much saving of time and labor over the former method of hauling poles by horse, but the central station is proving to Philadelphia business men, by the power of its own example, that the electric truck has limitless practical possibilities.

Electrical Construction

ELECTRICAL EQUIPMENT OF THE PACIFIC MILLS NEW PRINT WORKS DEPARTMENT.[1]

Wiring and Control Equipment for Direct-Current Apparatus.

By Theodore A. Bergen.[2]

As has already been mentioned it was necessary to furnish a certain amount of direct-current power for the plant on account of the requirements of a great many processes necessitating a variation in speed over such a wide range that it could not be accomplished with alternating-current motors; chief among these processes were those for printing and drying. A direct-current generating system having been decided upon, the next step was to select the most suitable system of control for the adjustable-speed motors. A great many different systems of this kind have developed, each one having its particular characteristics and advantages. It is not within the scope of this article to discuss these different systems, their characteristics or relative merits, but merely to briefly describe some of the more prominent features of the system which was finally installed.

This system is known as the Crocker-Wheeler four-wire multiple-voltage system. It is based on the principle of varying the speed of the motor by varying the voltage impressed on the armature. This is accomplished by introducing a so-called balancer, connected to the system as shown in Fig. 13. The balancer consists of three 50-kilowatt generators mounted on a common bedplate as shown in Fig. 14. On account of the heavy load on the system, and in order to insure maximum efficiency and reliability, two identical balancer sets were installed, connected in parallel. The terminal voltage of the different dynamos are respectively 40, 80 and 120 volts. The connections being as shown in the diagram,

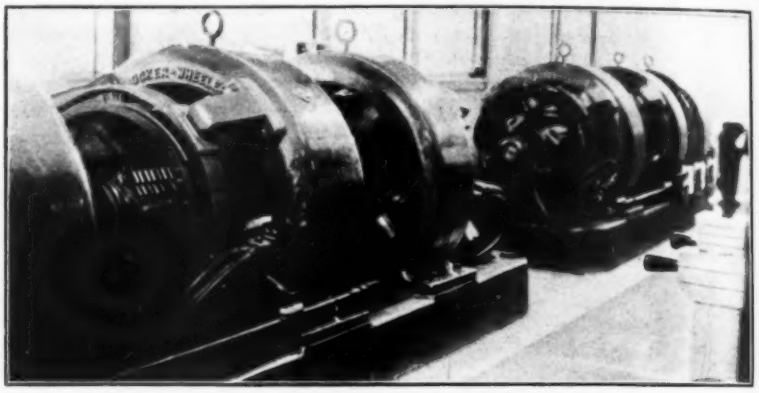


Fig. 14.—Balancer Sets.

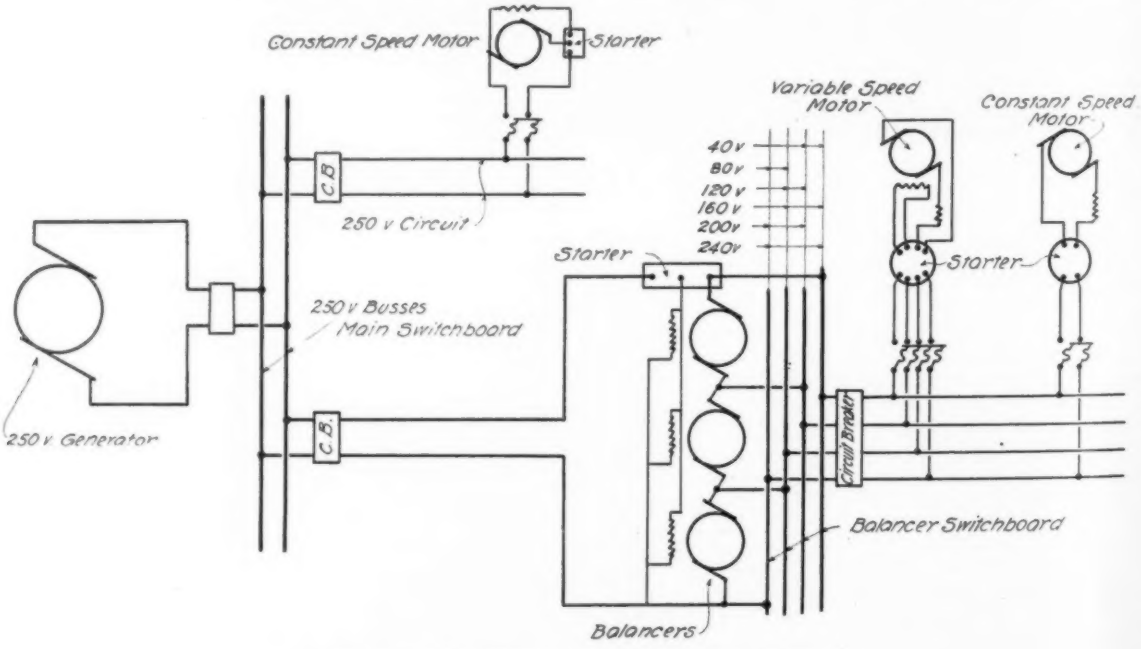


Fig. 13.—Wiring Diagram of Multiple-Voltage System.

[1] Second Installment.
[2] Electrical Engineer with Lockwood, Greene & Company.

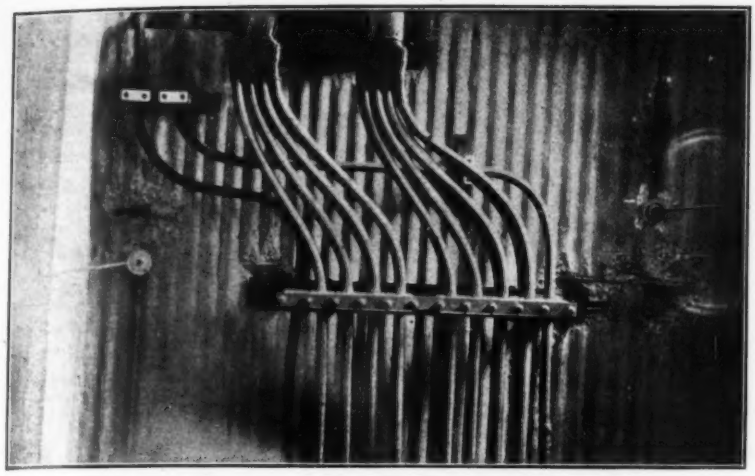


Fig. 15.—Direct-Current Mains Connecting to Busbar Extensions.

it is evident that as many as six different voltages are obtainable; namely, 40, 80, 120, 160, 200 and 240 volts. The ratio of the motor speed for the lowest and the highest voltage is approximately

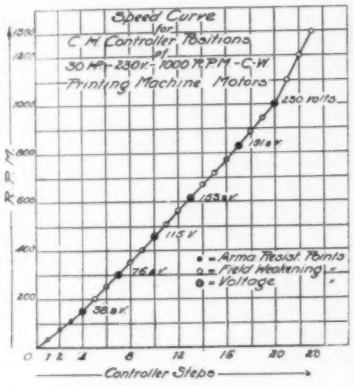


Fig. 16.—Speed Curve.

as one to five. The controllers, being of the drum type, are so designed that between the voltage steps resistance is introduced in the field circuit, which brings the motor up to the speed of the next voltage step, and thus a uniform variation of speed is obtained throughout the range, the speed curve (as shown in Fig. 16) being almost a straight line. By introducing resistance in the armature circuit of the motor below the lowest voltage point, it is possible to reduce the speed to any desired value. The voltage points given on the speed curve correspond with the voltages of the balancers, allowance being made for drop.

Some motors, where close speed adjustment is not required, (for instance, elevator motors, fan motors, or motors for coal handling machinery), are not connected to the multiple-voltage system. They are fed by separate two-wire feeders directly from the main switchboard, and what little speed adjustment may be necessary is accomplished by means of resistance in the field circuit. In a few cases motors of this kind are also connected to the two outside wires of the multivoltage system.

The balancer equipment is located in the center of the printing building, on a platform or gallery erected in the first story. It consists of the two balancer sets already mentioned and a nine-panel switchboard, controlling these

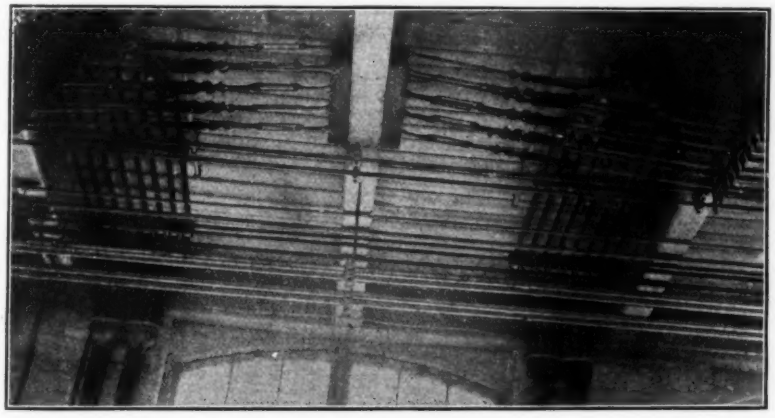


Fig. 18.—Typical Method of Installing and Anchoring Multi-Voltage Feeders.

balancers and outgoing circuits. At present there are nine circuits going out from this board; four for the printing department, one for the aging department, and four for dry cans, tenters, etc., located in the central building. Each circuit is controlled by a four-pole automatic circuit-breaker and provided with a system of watt-hour meters registering the energy for each group or department. The panel equipment for each of the balancers consists of a starter, a disconnecting switch, and a circuit-breaker.

The feeders from the main switchboard to the balancer switchboard have a maximum capacity of 5,500 amperes. The distance is about 600 feet. They consist of sixteen 600,000-circular-mil cables, run open and supported on cable racks anchored on the bottom of each beam. The cables are connected to the busses of the main switchboard in a manner similar to that employed for the generator leads, viz., by copper bars extending from the busbars proper to a

Fig. 17.—Feeders to Balancer Switchboard Passing Through Wall.

point near the ceiling of the basement. From this point the feeders are run through the filter-bed room (Fig. 2) and basement of printing building to a point directly under the balancer gallery, where they are dead-ended to one of the concrete beams. Connections to balancer board are again established by means of copper bars, which are incased in a wire-lath and plaster inclosure and pass through the floor and lower portion of the first story to a point behind the board where they connect with the busses. Throughout the distance where the cables pass through the filter building they have varnished-cambric insulation; in the printing building they have slow-burning insulation.

All direct-current feeders from the main switchboard are equipped with disconnecting switches, automatic circuit-breakers, ammeters, and watt-hour meters. The circuit-breaker for the feeder to the balancer switchboard is motor operated.

Figs. 1., 17 and 21 show construction details of the feeder between the two boards.

The multivoltage circuits are generally run open, consisting of slow-burning cables and are as described for the main feeder. The four circuits for the printing department consist each of two 850,000-circular-mil cables (outside) and two 700,000-circular-mil cables. For circuits to the central building the outside wires have a capacity of 600,000 circular-mils, the others 500,000.

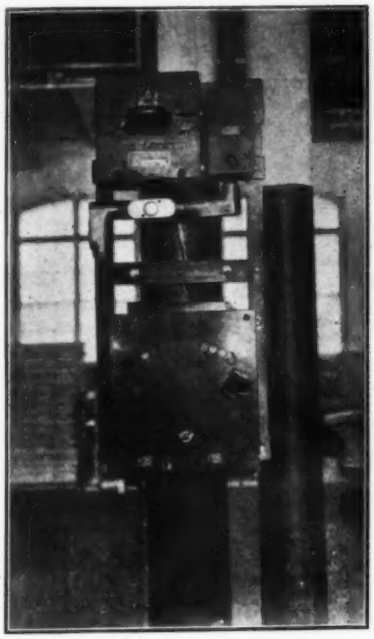


Fig. 20.—Controlling Apparatus for Constant-Speed Direct-Current Motor.

Fig. 18 is a typical view, showing the method of installation of these mains. As will be seen, the four circuits are run from the switchboard in conduit up to the ceiling of the second story, where they branch off in opposite directions and are run as open wiring, spanning from beam to beam. Wires in conduit have varnished-cambric insulation; those run open have slow-burning insulation. The cambric-insulated wires leave the conduits through approved conduit fittings, after which they are run for a short distance on cleats on the ceiling and then drop down and connect by means of Dossert connectors to the slow-burning horizontal wires. These wires are supported on the under side of each beam by standard racks, in which alternate insulators have been left out so as to obtain proper spacing. At ends and turns the wires are anchored as shown in the photograph. This anchoring is done by means of a channel iron, fastened by heavy through-bolts to the

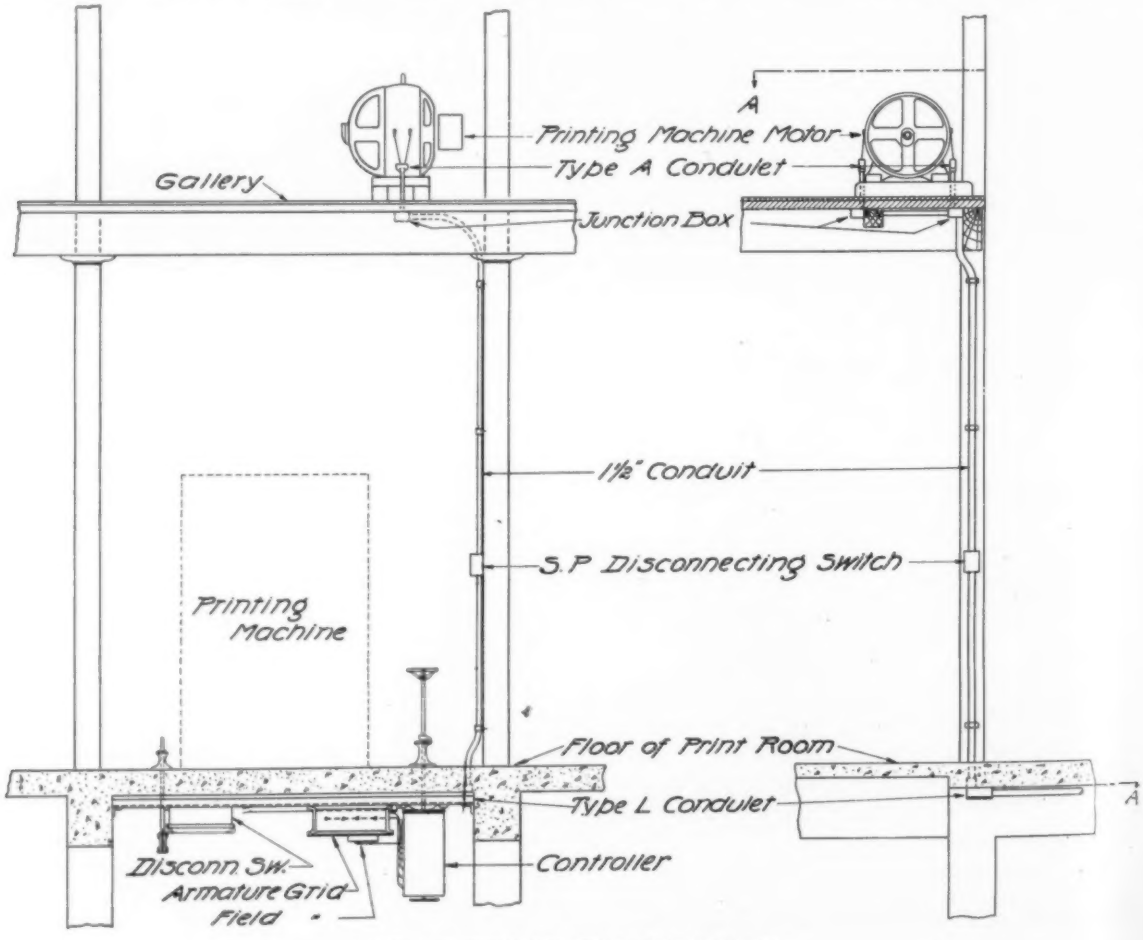


Fig. 19.—Some of the Details of Motor Wiring.

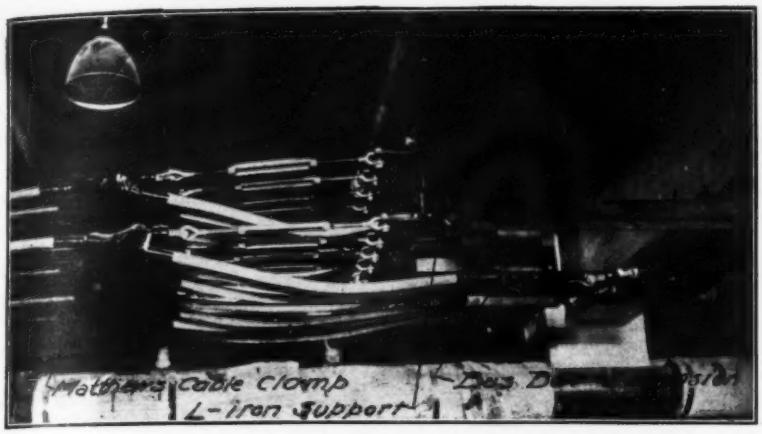


Fig. 21.—Feeder to Balancer Switchboard Connecting to Busbar Extensions.

side of a beam; the flanges of this channel being drilled and the eye-bolts which form a part of the turnbuckles engaging direct in the holes. On the other side of the turnbuckle is a strain insulator, to which the cable is attached by means of a Dossert connector of the so-called back-lug type. This construction is shown in detail in the right-hand side of Fig. 24.

The machines are installed on the second floor and are driven individually by motors installed in the gallery or third floor, the motors being belted to the main-drive pulley of the machines.

(To be continued)

230-Volt Motors to be Required.

A circular letter to electrical contractors engaged in wiring buildings to be connected to the lines of the Commonwealth Edison Company, of Chicago, has just been issued by Arthur P. Good, chief inspector for the company, which announces that on and after July 1, 1913, the Commonwealth Company will require that alternating-current motors which operate intermittently and start frequently, such as motors driving coffee mills, shoe-repairing machines, electric pianos, meat grinders, beer pumps, peanut or popcorn roaster, etc., must be wired for and operated on 230-volt service. The rule will aply to all sizes of motors, and will make it necessary to provide for a three-wire meter in all cases where such motors are installed. The letter goes on to say:

"We have found by a large number of tests that these motors require a far greater current in starting than their nameplate rating would imply. They are therefore a constant source of disturbance on our secondary lines, since not only consumers in the building where the motor is located but many others on the same secondaries are inconvenienced by the intermittent drop in voltage and the resulting fluctuation in the lighting service. The installation of 230-volt motors will reduce the starting current to one-half what it is with motors of the 115-volt type."

Fig. 22.—View of Print Room Gallery.

Fig. 23.—View of Print Room.

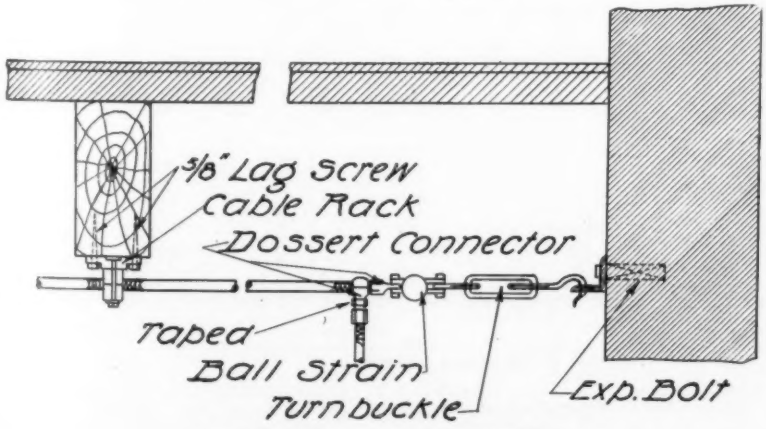


Fig. 24.—Method of Anchoring Cables.

House-Wiring Campaign in Chicago.

It is announced that as soon as the necessary forms can be made out the Commonwealth Edison Company, of Chicago, will put into operation the plan of permitting local electrical contractors in the city to solicit the wiring of already-built houses on the deferred-payment plan. The Commonwealth Company will pay the contractor for the job upon his presentation at the company's offices of a certificate of final approval from the City Bureau of Electrical Inspection, it is stated, but the property owner will be allowed to reimburse the central station company for the wiring on a liberal instalment system after the use of electric service has been begun.

The company does not engage in the wiring of new buildings at all.

A New System of Conduit Work.

One of the most difficult problems encountered in designing the electrical work in buildings of certain classes is that of selecting the best locations for the ceiling outlets. And after the best that is possible along this line has been done it is often necessary, when the building is ready for occupancy, to add new outlets or to change the locations of some of those already installed. Moreover, such revisions of the wiring are quite liable to be troublesome to make in a manner that is satisfactory. To take a specific example, consider the modern type of fireproof office building. The requirements of the tenants on any floor of such a building can hardly ever be fully anticipated while the wiring is being done; the work can only be laid out to meet their probable needs, and then when the arrangement of the offices is definitely known, important changes in the location of the ceiling outlets may be found to be desirable. Thus, at best, it becames necessary to do more or less objectionable cutting and patching in the ceiling. This process is expensive, and if the work is not done by skilled workmen the ceiling structure may even be materially weakened.

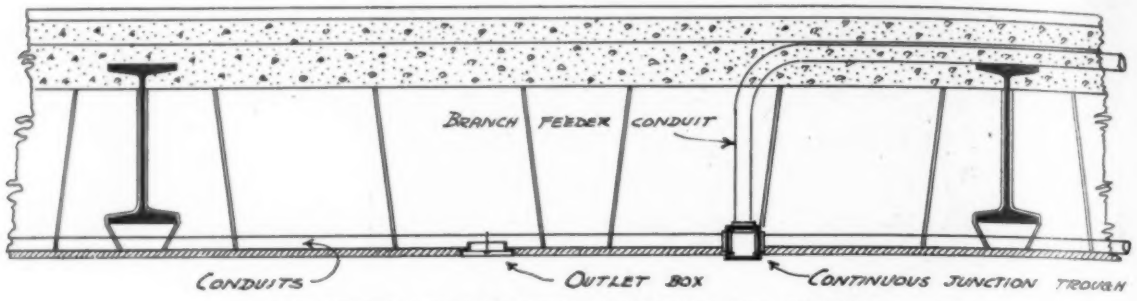


Fig. 1.—Sectional View of Construction in Flat-Arch Floor and Ceiling.

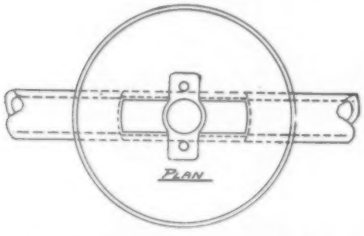


Fig. 2.—Plan View of Outlet Box.

Having realized the foregoing difficulties, from experience in the construction field, a firm of electrical contractors in Chicago has just completed the development of a new and very interesting system of concealed conduit construction, the principal object of which is to provide new lighting outlets in a building without the necessity of resorting to any objectionable cutting of ceilings and floors and the consequent patching of the plaster. This firm is known as the Universal Conduit System, and its headquarters are at 537 South Dearborn Street, Chicago. The new system of wiring is fully illustrated herewith. Patents for the system have been applied for.

Characteristic features of the construction under consideration consist in the fact that the conduits for the accommodation of the ceiling outlets are placed in the ceiling just above the plaster, and that, by means of a tool designed for the purpose, an outlet can be readily installed at any point in a run of conduit after the ceiling

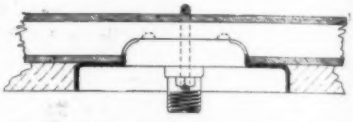


Fig. 5.—Cross-Section of Ceiling Outlet.

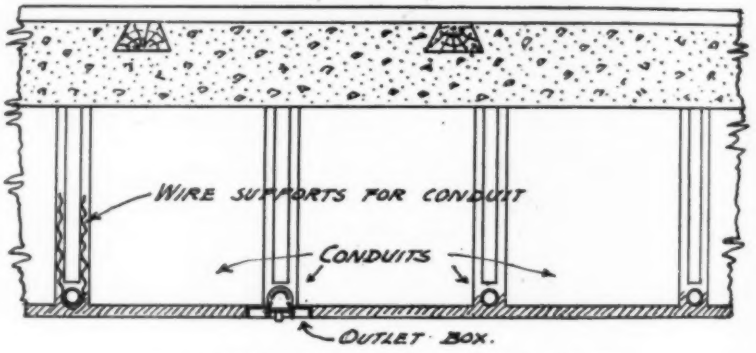


Fig. 4.—Another Sectional View in Flat-Arch Ceiling.

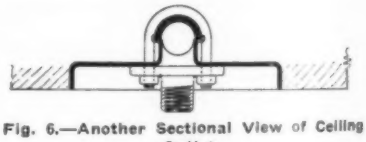


Fig. 6.—Another Sectional View of Ceiling Outlet.

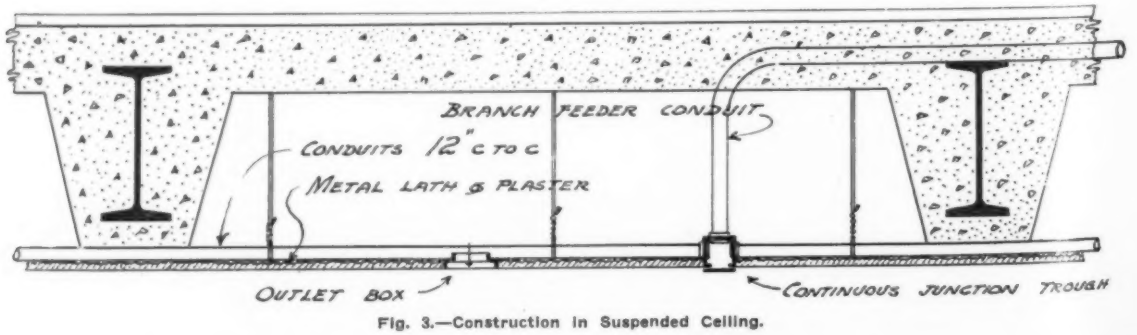


Fig. 3.—Construction in Suspended Ceiling.

is finished, without the necessity of cutting a hole in the plaster larger than can be covered with a fixture canopy and concrete the conduits are so placed as to accommodate the most likely requirements as to the location of the

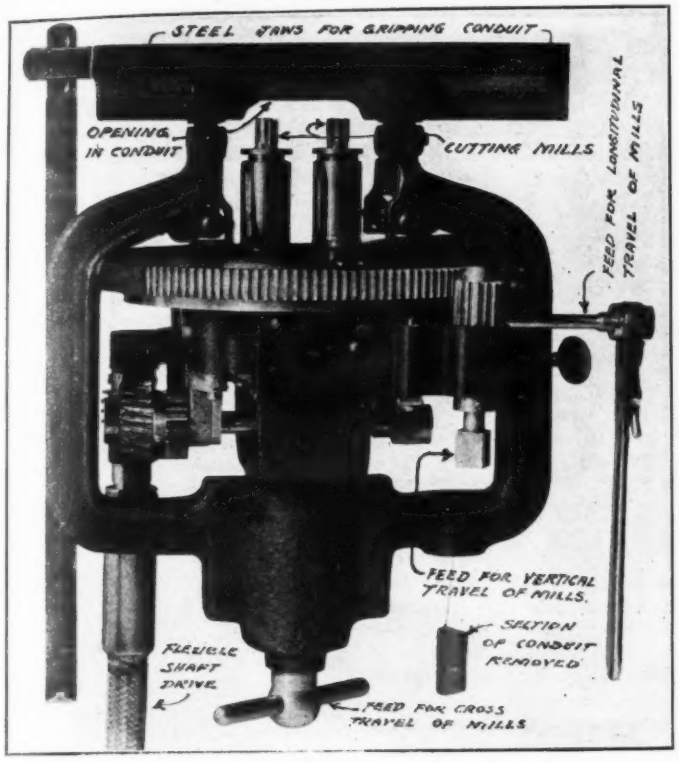

STEEL JAWS FOR GRIPPING CONDUIT
OPENING IN CONDUIT
CUTTING MILLS
FEED FOR LONGITUDINAL TRAVEL OF MILLS
FEED FOR VERTICAL TRAVEL OF MILLS.
SECTION OF CONDUIT REMOVED
FLEXIBLE SHAFT DRIVE
FEED FOR CROSS TRAVEL OF MILLS

Fig. 7.—Machine for Cutting Away Conduit at Outlets.

construction or of other construction with suspended ceilings the conduits are run 12 inches between the centers and are used in place of the small channels ordinarily employed for the ceiling construction, the metal lath be-

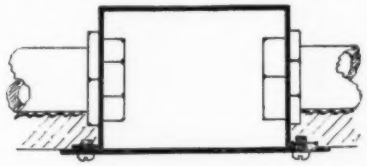


Fig. 9.—Section Through Junction Trough for Suspended Ceiling.

ing attached directly to the conduits.

A junction box is provided by the use of a continuous metal trough having a removable bottom cover, which

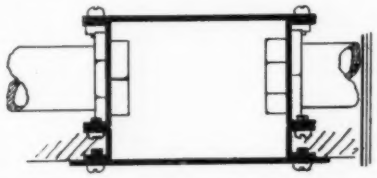


Fig. 10.—Section Through Trough for Flat-Arch Ceiling.

troughs are placed on the ceilings at intervals of about 60 feet, or, where possible, along the corridor walls. This trough is connected to the panel cabinet with as many one-inch con-

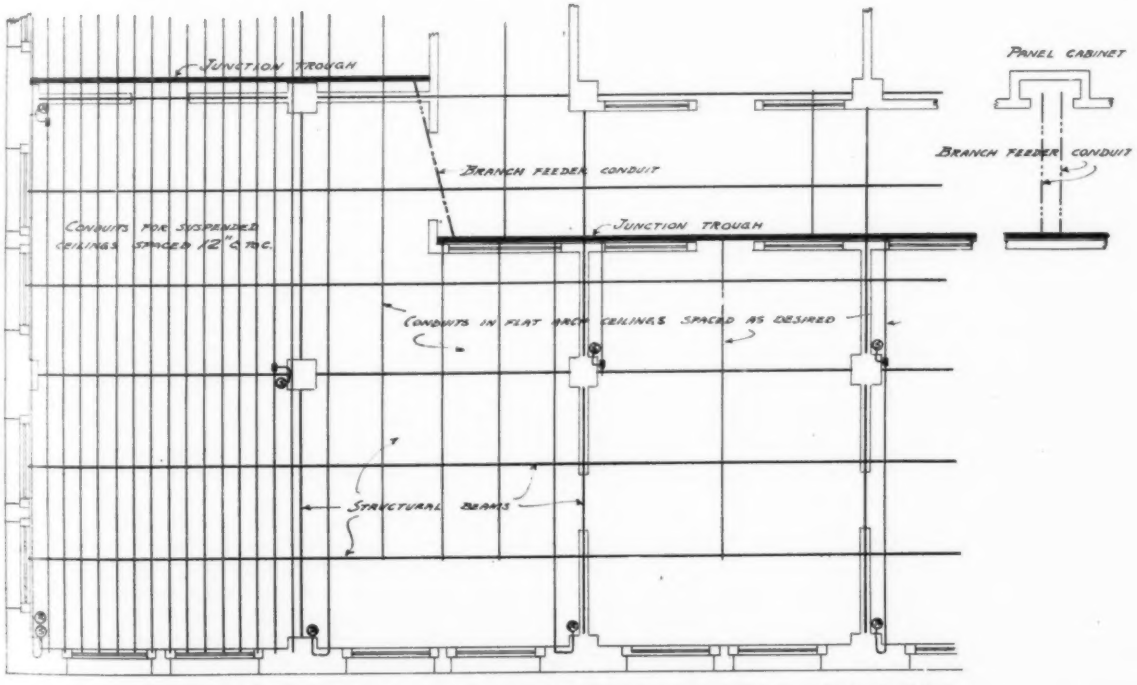


Fig. 8.—Portions of Floor Plans for Suspended Ceilings and for Flat-Arch Construction.

of the usual size. In buildings whose various floors are of the tile-arch construction or of a combination of tile lights both for the present and throughout the subsequent life of the building; but in the case of concrete duits as are required to supply current to the different circuits.

Outlets are provided by milling out

the lower half of the conduit for a length of about two inches with the special milling machine already referred to, and attaching an outlet box of a special design to the pipe at this point.

Such, in brief, is a general description of the system. To get a clearer understanding of details a study of the accompanying drawings is all that is necessary.

Fig. 1 is a sectional view at right angles to the direction of the floor beams in a floor of the flat-arch construction, and Fig. 4 is a section taken parallel with these beams in the same floor. The former figure shows part of one of the conduits which extends from the junction box to the distributing panel, this being marked "Branch Feeder Conduit," and also runs of branch-circuit piping extending in either direction from the junction trough. In the latter figure sectional views of four branch-circuit conduits are included, the second one from the left side of the figure having an outlet box attached to it. This cut also indicates the method of installing the conduits in the tile arch and providing the necessary support for them. Details of the junction trough and of the position of the branch-circuit conduits in the tile arch are brought out in Figs. 9, 10 and 11.

Fig. 3 shows how the Universal Conduit System construction is applied in a building of the so-called suspended-ceiling class. From this figure and the foregoing notes, the reader should have no difficulty in getting an accurate idea of the methods employed in putting in the work here.

A particularly interesting thing about this system of conduit work is the method of attaching the ceiling outlet boxes. The machine shown in Fig. 7, which is usually driven by a small motor, is employed to cut the necessary hole in the conduit. The first step in the process is to make holes through the plaster, to the conduit, for the steel jaws which grip the conduit and thus support the machine. This having been done, but a few minutes is needed to mill out an opening in the pipe, with which milling the wires in the conduit need not interfere at all. The hole having been cut, the ceiling-outlet box, the special features in the design of which are brought out rather well in the plan view of Fig. 2 is attached by means of a *U*-bolt which is passed over the top of the conduit. In addition to the outlet box, the *U*-bolt forms the support for the fixture stud, as is shown in Fig. 6. When the box has been installed and the electrical connections properly made, the installation of the fixture canopy usually completes the job.

Among the Contractors.

The Alloway Electric Company, of Chicago, has been awarded the contract for the wiring in a building owned by F. H. Anderson, in Chicago, where circuits for 600 incandescent lamps will be installed.

NePage, McKenny & Company, electrical engineers and contractors, with offices in Portland, Ore., Seattle, Wash., Vancouver and Victoria, B. C., and Spokane, Wash., have been awarded the complete electrical installation for the new twelve-story Davenport Hotel, in Spokane, Wash. The cost of the hotel will be $1,500,000. This is the largest electrical installation of the kind that has ever been let in the city of Spokane. The hotel will be one of the most modern in the Northwest. Rooms are to be equipped with solenoid door switches; all rooms to have telephone system, and the lighting equipment to be one of the most artistic in the country. Mr. Davenport, president of the hotel company, states that he is going to have a lighting system in this building entirely different from that in any other hotel in the United States. NePage, McKenny & Company have also been awarded the complete lighting, power, telephone, bell and fixture installation in the McBride Opera House, Victoria, B. C.; cost of the building, $400,000. This theatre will be one of the most modern in British Columbia. It will be used for high-class attractions only. The firm mentioned is at the present time installing some of the largest equipments in the Northwest, the most important of which are as follows: The new $500,000 Multnomah County Library, Portland, Ore.; the 10-story Multonmah Securities Building, Portland, cost $150,000; L. C. Smith Building, Seattle, Wash., cost $1,500,000; 10-story Green Building, Seattle, cost $400,000; the Fleischmann Yeast Company's Plant (8 buildings), Sumner, Wash., cost $500,000; the Central School Building, Tacoma, cost $200,000; the 10-story Birks Building, Vancouver, B. C., cost $400,000; the 15-story Weart Building, Vancouver, cost $500,000; the 10-story Yorkshire Guarantee & Securities Building, Vancouver, cost $300,000; the 10-story British Columbia Permanent Loan Company's Building, Victoria, cost $150,000; and a number of isolated plants and pumping equipments throughout the Northwest territory.

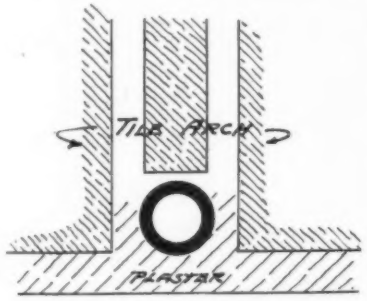


Fig. 11.—Section in Ceiling.

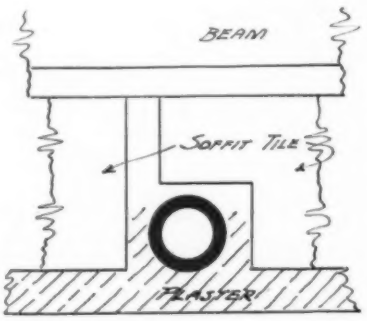


Fig. 12.—Another Sectional View of Ceiling.

Electricians Locked Out.

The Building Construction Employers' Association in Chicago declared a lockout of workmen on buildings in the city last week which threw several hundred electrical workers out of employment, temporarily at least. While officials have been very reticent in the matter of giving out information, it appears the act which nominally precipitated the lockout was the striking of the marble setters on the Continental and Commercial National Bank Building, now under course of erection. When these workmen walked out after an unsuccessful effort to secure an increase in wages, the electricians declared a sympathetic strike, and, it is said, declined to consider arbitration. Thereupon the practice of the local union of electrical workers in the matter of supplying maintenance men in new buildings came up for consideration, it seems, this matter having been one about which there had already been some contention. This maintenance man is the electrician who looks after such small temporary work, replacing of fuses, etc., as may be necessary between the time the building is begun and its completion. It was when the union insisted on keeping an outside man continuously on the job at full pay for such service as this rather than have an employee of the electrical contractor on the building take care of the maintenance and receive pay only for the time actually employed, that the Chicago Association of Electrical Contractors decided to co-operate with the other employers concerned in calling a lockout, it is stated. A settlement of the disorder is not in sight at the present time.

Public Service Commissions

MASSACHUSETTS.

The Railroad Commissioners of Massachusetts have issued an order directing that all railroad companies in the State shall replace existing "ball signals" with interlocking signals of modern type before July 1, 1914. This action is taken as a result of a collision between two trains on the Boston & Maine Railroad at South Lawrence June 3.

The Gas and Electric Light Commissioners of Massachusetts have consented to the establishing of a price of five cents per kilowatt-hour for electricity for heating, by the municipal light board of Marblehead, this price being less than cost. The Board's decision follows somewhat the same lines as that rendered in the recent Westfield case, in which the municipal plant was granted permission to sell electricity for power at two cents per kilowatt-hour in large units, this being less than the average cost. An abstract of this decision was given in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of June 7, 1913.

The Marblehead plant has been operated by the town since 1894. Since February 1, 1913, the rate for heating has been seven cents per kilowatt-hour. At that time the municipal light board announced its intention to make a reduction to five cents if the Commission's consent could be obtained.

The computation submitted by the municipal light board of the cost, as defined by the statute, was 6.56 cents per kilowatt-hour, based on the returns for the year ending June 30, 1912. The prices for electricity hitherto prevailing have been: for lighting, 15 cents a kilowatt-hour, with a discount of 20 per cent for prompt payment. For heating, the rate has been 10 cents per kilowatt-hour for 50 hours or less used in one month, nine cents if 100 kilowatt-hours or less are used; eight cents for 175 kilowatt-hours, etc., until 2,000 kilowatt-hours per month are charged for at four cents per kilowatt-hour. No discounts are given at these prices.

Though this heating schedule has been in force about three years, there have been obtained only three customers of this class of service, and it does not appear that any of these use sufficient electricity to make effective the prices which are less than the computed cost of 6.56 cents.

The Board refers to its discussion of the Westfield case and says that it is not called upon to prescribe what rates should be established nor to specifically approve that presented by the town, but rather to determine whether or not the rate proposed is likely to be prejudicial to the interests of the taxpayers or consumers generally.

The new heating rate was urged by the municipal light board after experience with a schedule of higher prices had demonstrated that they are too high to secure business of that class. The price of electricity for heating, the Board says, is not necessarily governed by the apparent cost of supplying it, but depends rather upon its value to the customer. It may under some conditions be furnished for this purpose at less than the average cost without actual loss to the town engaged in the supply. The propriety of trying to obtain this class of business is a matter of commercial expediency. If the endeavor results in increasing outputs without proportionately increasing costs, there is commercial justification for trying the experiment, and the interests of taxpayers and customers generally may be promoted. The Board grants its consent with the understanding that should experience not justify its continuance the Board may intervene.

The mayor of Northampton has petitioned the Massachusetts Gas and Electric Light Commissioners asking for a reduction in the price of municipal lighting in that cty.

The Attleboro Steam & Electric Company has petitioned the Commission for approval of an issue of 533 shares of new capital stock at $150 per share.

The Amesbury Electric Light Company asks approval of an issue of 1,750 shares at $100.

The Quincy Board of Trade has petitioned the Commission asking for a reduction in price of electricity furnished in that city by the Quincy Electric Light & Power Company.

CALIFORNIA.

The Campbell Water Company applied to the Railroad Commission for authority to issue $25,000 of stock.

A decision was rendered granting authority to the Los Angeles & San Diego Beach Railway Company to issue $28,000 of notes.

The Pacific Gas & Electric Company was granted authority to sell certain property and water rights along Los Gatos Creek, Santa Clara County, to the San Jose Water Company, for $25,000.

The Torrance Water, Light & Power Company applied for authority to issue 50,000 shares of stock and $125,000 of bands, the proceeds of which are desired for the purchase of property.

The San Diego Consolidated Gas & Electric Company applied for authority to issue $639,000 of bonds and 3,148 shares of stock. The proceeds are desired to pay existing indebtedness and to make extensions.

Upon request of applicant, a decision was rendered dismissing the application of the Southern Sierras Power Company for a certificate of public convenience and necessity to serve the city of Redlands.

A supplemental order was issued granting authority to the Tulare County Power Company to pledge $23,000 of bonds as collateral security for a loan of $17,202.57.

OHIO.

The Public Service Commission has authorized the sale of a number of central-station properties to the Ohio Light & Power Company, and the latter has been authorized to purchase for the following sums: Peoples Electric Light & Power Company, Shawnee and New Straitsville, $40,880.34; The Perry Electric Company, Crooksville, $25,814.29; The Logan Light & Power Company, Logan, $71,912.34; The Lancaster Electric Light Company, Lancaster, $201,791.10; The Fremont Yaryan Company, Fremont, $363,178.05; The Licking Light & Power Company, Newark, $426,860.66; Field W. Swezey, Fostoria, O., $146,856.45; George N. Tidd, New Lexington, $46,206.78; Frank B. Ball, Mount Vernon, $216,611.19.

The Greenville Electric Light & Power Company, Greenville, has been authorized to issue common capital stock to the amount of $10,000, to be sold for not less than par, the proceeds to be used to discharge indebtedness incurred in making extensions and improvements.

Questions and Answers.

All readers of the Electrical Review and Western Electrician are invited to submit questions and answers to this department. Full names will not be printed except where the writer indicates his willingness therefor. Anonymous communications will not be considered. Questions relating to electrical matters of any kind will be inserted. Answers from our readers should be received in this office preferably within ten days of the date of publication of the question, and will be published in a subsequent issue. Payment will be made for all answers published.

Questions.

No. 142.—Allowance for Reduced Maximum Demand in Summer.—Recently I read an article explaining a rate system used by a British central station in which the number of hours charged for at the primary rate was less in summer than in winter, so as to compensate for the reduced maximum demand and decreased lighting load in summer and to encourage the use of electricity for cooking. Is this system in use anywhere in this country?—F. D., Racine, Wis.

No. 150.—Meters Outside the Building.—Is the installing of meters on the outside of buildings under verandas considered good practice? Would frost have a bad effect on the mechanism of the meter?—R. M., St. Catharines, Ont.

No. 151.—Copper Wire Base.—Will some one kindly explain how the base on copper wire is calculated from standard spot or electrolytic copper quotations? If the wire base is not calculated from the quotations, kindly explain how it is calculated.—R. L. L., Minneapolis, Minn.

No. 152.—Motor Trouble.—I am having trouble with a double-commutator Commercial motor and controller. Both were taken down for repair and it is possible that tags marking the terminal wires were not put on properly. At any rate, I have failed to get the machine properly connected again. The manufacturers of this motor are out of business and I am unable to get a connection diagram from them. Can any reader furnish such a diagram?—T. N. P., Connersville, Ind.

Answers.

No. 137.—Gas-Electric Cars.—What kind of motors and what system of control are used on gasoline-electric automobiles and railway cars?—P. B. V., San Antonio, Tex.

I would respectfully add to the answer to this question already published (May 10), that during the last 15 years I have designed and constructed what are termed "petrol-electric" vehicles, and I note with interest the remarks concerning the rail cars now running in America. Based on a good many years of practical experience I am of opinion that the system of placing an engine on the car of sufficient power to meet the conditions of grades and accelerations direct is not of commercial value because of the fact that at all other times the engine is operating under wasteful conditions as regards fuel. The system that embodies a small storage battery (Edison) is the one which, in my opinion, is most efficient in cost of fuel per ton-mile, because in that case the engine is always operating under full revolution speed and load. At the same time an engine of about half the power (or even less) is required to generate the variable torque and speed necessary for railway traction. Such a system, using polyphase alternating-current transmission with variable frequency and voltage is about to be placed on the market, and will operate on compressed town or other gas for the prime movers. From calculations made, and figuring out the petrol as having 20,000 British thermal units per pound, and town gas having 550 British thermal units per cubic foot at atmospheric pressure, the cost per ton-mile will be about half. Real electrical engineering is now about to compete with the early Victorian method of steam-hauled, main trunk line trains, and what in the past has been termed the "barking, stinking, noisy abomination" that we know as the internal-combustion engine will become the Cinderella of the electrical traction profession the world over. Such locomotives of 1,000 horsepower have now been designed and will be in operation before long.—Wm. P. Durtnall, London, England.

No. 140.—Electrical Equipment of Gasoline Automobiles.—Which type of electrical equipment is better for gasoline automobiles, to have the electric starting, lighting and ignition combined in one system, or to have a separate outfit for each purpose? What are the advantages of each plan?—C. B. W., St. Joseph, Mich.

The best system for a gasoline automobile is to have a direct-current generator of the proper voltage, driven from the engine, charging a storage battery. The ignition should be taken from the storage battery, stepped up to the high tension through a coil, and preferably so stepped up and distributed by means of an ignition device rather than through the ordinary distributor. An ignition device will give just as hot a spark on high speed as on low speeds. In fact, there will be no difference in the spark intensity whatever the speed of the engine. The ordinary distributor gives a continued hot spark on the low speeds, while the magneto has a tendency to give a weak spark on low speeds. There is no need of a magneto with a properly designed mechanical ignition device. Magnetos are continually breaking down and becoming demagnetized. An ignition device in duplicate is very much more satisfactory than either a magneto or a combined magneto and coil system. The starting motor on a combined starting and lighting system should preferably be separate from the generator, and should be a series-wound motor for the reason that the series motor has the highest starting torque and has electrical characteristics much to be preferred for this service than those of the generator which is used to charge the battery. The generator, of course, should either be a shunt-wound generator or a compound-wound generator and so designed that it will not furnish too high a current on the high speeds of the engine. Up to this time we have said nothing in regard to the best voltage of the battery. I might mention in passing that in my opinion, all starting and ignition batteries up to the present moment are not designed right; neither are they of sufficient capacity; they have been designed by the automobile manufacturer, to use his words, simply as "something which will get by." Even with the capacity of the present batteries, the capacity of the present generators is not sufficient to keep the present batteries in good condition. The proper voltage of the battery is a question for this reason. A six-volt battery will allow the filaments of the lamps to be made short, stubby and strong, whereas a 24-volt battery would require the filaments of the lamps to be much longer, much smaller in diameter, and consequently very much weaker and less likely to stand up under the jolts and vibration of road service. A 24-volt battery, on the other hand, would enable small wires to be used in the wiring system as well as on the electric generators and motors themselves; and would give machines which would have greater overload capacity, and in consequence, a machine less likely to give trouble than the smaller eight-volt generators and six-volt batteries. The small eight-volt generators and six-volt motors require large wires in the system as well as for their fields and armatures. The problem seems to be best solved by using a 12-volt battery which would be always in series. That is, there would be 12 volts on the lighting and ignition systems at all times, as well as on the starting system. The scheme of starting the starting motor using six volts and then seriesing the battery to 24 volts is extremely objectionable, troublesome, and is bad engineering practice. I recommend an 18-volt generator for charging six cells of storage battery of ample capacity, the lighting to be taken directly off this 12-volt battery, while the starting motor should be a 10-volt series-wound machine.—R. L. L., Minneapolis, Minn.

No. 145.—Interference of Power and Telephone Lines.—It has always been stated that by careful transposition of telephone lines inductive disturbances to them from any other adjoining overhead circuits is prevented. In California much

difficulty has been experienced by telephone companies from the neighboring lines of power companies. Is this due to improper transposition or is ordinary transposition ineffective against induction from high-tension lines?—W. M. S., Ogden, Utah.

Induction on telephone circuits due to exposure to parallel high-tension wires may be either magnetic or static, or a combination of both. The latter is usually the case although static induction most always predominates in long lines. Provided the resistance, balance and insulation of the telephone lines are as they should be, it may be possible to transpose them effectively against induction. If static induction predominates and there is a ground on the high-tension system, transpositions will do no good. In cases where the high tension is three phase, there may be capacity unbalances between the three wires or between the wires and ground due to their pin positions on the poles. This can sometimes be corrected by transposing or "barrelling" the wires. If the three-phase line is Y-connected, the neutral may be grounded at each end. Unless the load is carefully balanced on each phase, triple-frequency ground-return currents occur, which will produce troublesome induction. Even when delta-connected, an unbalance of load on the phases upsets any mutual balance that might normally exist between the power and telephone lines and produces magnetic induction. It may not be the fundamental frequency of the high-tension circuits that causes noise complaints so much as the higher harmonics which are always present. The telephone receiver is much more sensitive to such high frequencies than it is to 25 or 60 cycles and it may be found practically impossible to transpose completely against them.—B. L. D., Arlington, Mass.

High-tension power lines interfere with telephone lines in three ways: First, by mutual induction; second, by direct leakage; third, by the introduction in some way of a static charge. While theoretically it would be possible to transpose telephone lines so that all induced currents would be neutralized, it is practically impossible to do so in severe cases, particularly where the telephone line runs on the same pole with the power line. The only absolute method of neutralizing the high-tension induction would be by running a twisted pair. I am, of course, speaking of extreme cases of interference. Usually it is possible by a studied transposition to cut the induced currents down to a negligible quantity. The static may be gotten rid of by either a vacuum carbon or carborundum lightning arrester, the vacuum carbon arrester being preferable. The leakage is the most difficult thing to handle and I know of no way to handle this except to insulate heavily the weakest parts. The writer has experimented with balancing the induced currents at each terminal of the telephone line by means of impedance coils. This can be done satisfactorily with a little time and trouble. In the case where the induction is caused by neighboring lines, I should say that proper transposition would be effective. Ordinary transposition is usually designed to counteract the influence of composited or simplexed circuits and also the effect of neighboring telephone lines. Therefore, an altogether different system of transposition should be adopted in order to neutralize the mutual induction from the neighboring power lines. This system of transposition should be so designed as to neutralize the effect from the neighboring power lines as well as to produce no effect from the adjacent telephone circuits.—R. L. L., Minneapolis, Minn.

The matter of interference between power and telephone lines has been the subject of numerous experiments, some of which have developed terminal transformers and various transposition systems to reduce to a minimum the inductive disturbance in a telephone line, caused by paralleling power or telegraph lines. Theoretically a properly designed transposition system will eliminate the disturbance, but practical conditions are often such that it is neither practicable nor economical to place enough transpositions in the telephone lead to entirely eliminate the disturbance. If a transposition system could be designed so that the circuits would be absolutely balanced, no trouble of an inductive nature would be experienced. Owing to the local conditions, it is necessary for each case to be considered separately. Of course, systems can and have been devised to take care of the greater part of the induction, but these systems do not take care of changes in the power circuit, such as power transformers, power taps and branch power leads, nor do they cover variations in the distance between the power and telephone lines. It is for this reason that special transpositions must be cut in the telephone line and often in the power circuit, particularly so when the power circuit is a multiphase circuit. It is, therefore, evident that the transposition scheme used to "kill" the induction is somewhat complicated. Then also the necessity of spacing the telephone poles at intervals, does not lend itself readily to a system of transpositions, which will eliminate the power induction and still retain the balance between the telephone circuits on the same lead. In many cases the transposition system will reduce the power induction to a working condition without introducing cross talk between the telephone circuits, which is oftentimes more objectionable than the power induction. This is true when the interfering power lead is not heavy and where the power lead carries a heavy current at high tension, special transpositions are necessary. The power lines in California are unusually heavy and numerous, and often parallel the telephone lines for considerable distance. The separation of the two lines also varies considerably, owing to the conditions of the country through which the pole lines pass. Every point at which a change is made in either the separation of the leads or the load on the power circuit, requires that that point be considered as the end of a transposition section. It is therefore rather difficult to transpose the telephone lead to reduce the inductive disturbance and yet not introduce severe cross talk between the telephone circuits, as the number of poles in a section of this nature is usually small and the required number of transpositions can not be made. In many of the cases the disturbance is due to an improper transposition scheme, and possibly to errors in the transpositions made by the field force making the transpositions. Then, too, the conditions are so severe that sufficient transpositions can not be made in the telephone line to eliminate the induction of a short section. To entirely eliminate the induction in some of the severe cases which the telephone companies in California have to handle, would require transpositions at every pole, in order to balance the exposure in any given section, and it is not practicable to do this from a telephone standpoint. —E. B., St. Louis, Mo.

No. 146.—Ozonator for Direct-Current Circuits.—Are any ozonators built for use on direct-current circuits or is it necessary to connect them to the alternating-current side of a motor-generator or inverted rotary converter?—B. J. L., Cleveland, O.

Ozonators are built in various ways to operate from direct-current circuits. One of the most successful is that developed by the Allsop Process Company, which uses a 500-volt direct current interrupted through a single impedance coil similar to a make-and-break gas-lighting coil, which gives a high voltage of induction when the circuit is interrupted. The current is interrupted mechanically by a wheel very similar to the break on a flasher, there being, of course, very many more breaks per minute than on the flasher. This produces practically a continuous sheet of flame. This sheet of flame combines the oxygen in the air so as to produce ozone. This process, before the introduction of the pure-food laws, was used extensively in flour mills for the bleaching of flour. Now that the Supreme Court has decided that the amount of nitric acid produced by this process is negligible and perfectly harmless, it will probably be put into operation again. Ozone could be produced in any way where an electric spark is produced in an atmosphere containing free oxygen. The drier the air and the smaller the percentage of nitrogen, the more ozone will be produced, and the less impurity. The ideal method would be to produce the spark in pure oxygen. —R. L. L., Minneapolis.

MEETING OF ILLINOIS ELECTRICAL CONTRACTORS.

Semi-Annual Convention of the State Asociation Held in Chicago, June 20 and 21.

The approach of the semi-annual convention of the Electrical Contractors' Association of the State of Illinois which was held in Chicago last week was kept before the members of that organization for some time by means of some especially unique and interesting advertising, prepared and distributed by the local committee on entertainment; and when the convention opened on Friday morning it was obvious that the efforts of the committee at securing a good attendance had not been lacking in effectiveness.

The opening session was called to order at 10 o'clock Friday morning by William McGuineas, of Chicago, the president of the Association, who introduced Ernest Freeman, also of Chicago, the popular and aggressive president of the National Electrical Contractors' Association. Mr. Freeman responded with a brief but very appropriate address of welcome to the visiting contractors. He reviewed the advantages of organization among representatives of the electrical interests, spoke entertainingly of the value of co-operation and exchange of ideas, and urged the freest possible discussion of such matters as might come up for consideration during the sessions of the convention.

At the conclusion of Mr. Freeman's address Mr. McGuineas announced that representatives of the electrical supply jobbers and of the electrical manufacturers would be called upon for short talks. The first of these to speak was J. A. Hoeveler, of the National X-Ray Reflector Company, who spoke on the general subject of show-window lighting and described his company's line of reflectors for window illumination. He was followed by G. A. Harter, of the Harter Electric Company, of Chicago.

At the conclusion of Mr. Harter's talk Chairman McGuineas called upon J. T. Marron, of Rock Island, to speak of the attitude of the jobber toward the electrical contractor. Mr. Marron discussed the practice of the jobber selling electrical goods to the contractor's customer at the same prices the contractor himself had to pay. He declared that this was a hardship on the contractor, and that it encouraged him to purchase his supplies from the manufacturer's agent rather than from the jobber. He thought that closer co-operation between the jobber and the contractor was a very pressing need.

At this point H. M. Butler, of the Mills Electric Company, of Peoria, stated that his company followed the practice of selling electrical supplies only to contractors and concerns that would not be likely to buy goods from contractors. The latter class included the owners of large industrial plants, street railways, and similar concerns.

A. S. Schulman, of Chicago, having been called upon for a talk, explained that his mind was so occupied with some labor troubles that had assumed very annoying proportions in Chicago that he did not care to undertake to do any talking. Charles R. Kreider, of Chicago, then responded to a call from the chair with an interesting discussion of the subject introduced by Mr. Marron. He declared that he was unable to see the argument for a wholesale dealer's engaging in the retail business. Mr. Kreider's own company, Kohler Brothers, of Chicago, had, on

W. J. Ball, President-Elect.

the day before the convention, secured settlement for an order of goods which cost the company $148 at wholesale, and which the company had billed to the customer at $170. The customer complained that the goods had been quoted him by a wholesale dealer at $145 and insisted that therefore Mr. Kreider ought to accept this amount in settlement of the bill, which, in order to avoid further annoyance and bitter feelings, he finally decided to do.

G. H. Lounsbery of the Western Electric Company stated that he was in favor of the jobber maintaining differential prices for electrical contractors, but he was afraid that a great deal could not be done so long as the contractor insisted upon buying from the manufacturer's agent instead of from the jobber. J. E. Barron, of the Holophane Works of the General Electric Company, thought that the Society for Electrical Development could be depended upon to bring the jobber and the contractor into closer harmony. His company had contributed liberally toward the financial support of this Society and would do anything else in its power to promote improvement.

Among the other speakers called upon by the chairman were L. B. Van Nuys, of Peoria; Guy Carlton, of Bloomington; R. W. Poelma president of the Chicago Association of Electrical Contractors; C. E. Stapp, of Peoria; E. W. Donoho, of the Hot Point Electric Heating Company; J. N. Pierce, of Chicago; and Clark Method, of the Manhattan Electrical Supply Company.

Election of Officers, Etc.

During one of the closed sessions a statement was received from R. C. Bierdemann, of Chicago, to the effect that he would be unable to continue as a director of the National Association from Illinois. He explained that he had recently greatly enlarged his business and had organized a company for the more extensive prosecution of it, and that therefore he would have but little time to devote to outside interests in the immediate future. F. L. Decker, of Chicago, was elected to succeed Mr. Bierdemann as a National director.

A Booster Committee was appointed, with Charles E. Stapp, of Peoria, as Chairman, whose duties will be the encouragement of the formation of local associations of electrical contractors in the small towns of the State. It is understood that in this work the committee will have the co-operation and assistance of the secretary of the Faraday Club of Chicago.

W. J. Ball, of Moline, was elected president of the Illinois Association, to succeed William McGuineas, and J. T. Marron, of Rock Island was chosen vice-president. M. N. Blumenthal and J. N. Pierce, both of Chicago, were re-elected secretary and treasurer, respectively.

Entertainment.

Saturday evening there was a most delightful banquet followed by an informal dance at the La Salle Hotel. A thing that impressed a visitor on this occasion especially was the absence of the perfunctoriness and lifely formality so common to such events and the prevalence, in its stead, of goodwill and refined enjoyment. During the speech-making which followed the splendid course dinner J. T. Marron served as toastmaster. Toasts were responded to by the following gentlemen: Ernest Freeman, A. M. Knauber, W. J. Collins, William McGuineas, Joe Cronin, F. L. Decker, E. H. Joseph, and Charles R. Kreider. The talks were all appropriate and entertaining. The evening was a fit conclusion of a successful convention.

Electric Club Report on Patent Legislation.

At the meeting of the Electric Club, Chicago, on June 19, an address was made by Alonzo Burt, vice-president of the Chicago Telephone Company on "Some Features of the Telephone Business."

Mr. Burt related a number of amusing anecdotes relating to his experiences in the telephone business and then gave an interesting account of the organization of the Chicago Telephone Company and the service it renders. The company now has over 400,000 subscribers connected, of whom 327,000 are within the city limits. The number of calls handled per day amounts to 1,750,000.

The report of the Committee on Patent Legislation was presented by the chairman, M. G. Lloyd, and was accompanied by resolutions, whose adoption was suggested by the Committee.

The resolutions urged upon Congress provision for a commission to be made up of independent nonpartisan men of national reputation, chosen from different walks of life, to thoroughly study and investigate all phases of the patent system of this and other countries, and that no legislation be passed until such a commission has reported its findings to Congress; that such legislation when enacted should include changes in the administration of the Patent Office, which will permit more thorough work and result in the validity of any patent being recognized until declared invalid by a patent court; the creation of a court of patent appeals; and disapproval of the Oldfield Bill, except the provision limiting the duration of a patent to 19 years. Action upon these resolutions was deferred until a future meeting. The main features of the report are given below. The other members of the Committee are Donald M. Carter, H. M. Frantz, T. P. Gaylord, W. P. Hoagland, Eugene A. Rummler, and Max W. Zabel.

Report on Patent Legislation.

In considering any proposal with respect to patents and our patent law it is desirable to first review briefly the objects intended to be achieved, the principles involved and the defects in our present system.

Our patent system is intended to benefit both the general public and the individual to whom the patent is granted. The latter receives a legal title to property which he has created, this property consisting of an idea which has originated with him and whose application will be useful. From the moral standpoint this idea is as much the property of the individual who creates it as any tangible property may be. Indeed the property claim may be considered superior to that in real estate, since land is not created by man and is acquired only by taking possession. Our laws give utmost protection, however, to the owner of tangible property, yet even under the protection of our patent laws the exclusive title to an invention is limited to a period of 17 years. Without the protection of a patent the only way in which the creator of new ideas can retain complete possession of them is through the medium of secrecy. Since it is exceedingly difficult to keep an idea secret at the same time that use is being made of it, it is usually considered advantageous for the inventor to disclose his idea, provided he is given a legal monopoly in its use even for a limited period.

On the other hand the patent system is of benefit to the public in discouraging the practice of secrecy and inducing inventors to make public their inventions for the unhampered future use of all mankind, and in stimulating inventors to greater activity by assuring them exclusive property right in their inventions.

The American system of patents is based upon the conception and application of these ideas and is no doubt one of the factors which has put the United States in the front rank of nations as an inventive people. This is reflected in the extent of our manufacturing industries. The American system is undoubtedly one of the best in the world and its results have been in the main satisfactory. There are, however, certain details of our system which it is usually conceded can be improved, and any change which is made in existing laws or practice should be with the idea of remedying these minor defects rather than in the line of making any radical departure from the main principles.

The principal objections which have arisen to our patent system are concerned with administration and court practice rather than with the statutory provisions. Under the court procedure which has been customary, patent litigation has been found to be very expensive and long drawn out. This litigation is almost entirely in the equity courts, being based upon a suit for injunction to restrain an alleged infringer from invading the monopoly granted to the patentee. Whether the litigant be involved in the suit as one seeking to prevent infringement, or whether he is being sued as an infringer of a patent which he regards as invalid, the burden is equally onerous. The cost has been such as to be almost prohibitive to the man or company of small means and great advantage naturally lies with wealthy men or corporations, whether they be enforcing or defending their legal rights, or whether they be taking advantage of the lack of resources of a competitor to infringe his patent or obtain other illegal advantage. In the words of one authority upon this subject, who is, himself, an inventor of note: "If our system of court practice had purposely been devised to help the patent pirate, it could not much be improved upon."

Almost equally expensive and sometimes interminable litigation is involved in interferences in the Patent Office prior to the issue of a patent. Interference cases arise through the contemporaneous claims of more than one inventor to priority of invention of the subject of the patent sought for. It is claimed that some interferences are not bona fide but are instituted for the purpose of harassing the inventor or widening the claims of an application, and are frequently utilized to delay the issue of the patent. The only incentive at present to dispatch upon the part of the applicant is the fact that in interference cases claims may be disallowed upon the basis of lack of diligence on the part of the inventor in seeking the issue of a patent.

Another defect in our present system is the fact that the validity of a patent is not established by its issue, but, in case the question of its legality comes up, must be decided in the courts before it is recognized or has any value. This has led to the common saying that a patent is nothing more nor less than a right to engage in a law suit. Not only is there this uncertainty as to the validity or value of a patent after issue, but since priority of invention is made the criterion of the right to a patent, a patentee may establish a factory and start operation only to find that a prior inventor has later appeared upon the scene and secured a patent, which after expensive and weary litigation is found to be valid, and puts him out of business. It is thus evident that an improvement could be made by expediting the issue of a patent and by providing greater likelihood of its validity when it is issued.

Since patent suits upon appeal are heard in one of the nine Federal Circuit Courts of Appeals, whose decision usually is final, a condition has been brought about in which a patent may be valid in one part of the country and not valid in another, owing to the limited jurisdiction of these courts and the fact that their decisions may not be harmonious. The remedy for this is a single court of patent appeals with jurisdiction covering the entire country

to whom appeals should be taken from the trial court.

It has been claimed also that the patent monopoly itself, while entirely proper when used for its intended purposes, may be so misapplied as to constitute a public evil. Three principal claims have been made in this connection. One is that patents may be bought from the inventor by some competing company and suppressed with the object of stifling competition. The second is that, under the guise of a license provision attached to the use of a patented article, the monopoly granted by the patent may be extended to cover unpatented articles, or may be used to restrain trade by limiting competition in handling the article after it has left the hands of the owner of the patent. The principal application of the latter has been the fixing of the resale price by the owner of the patent. The third is that the monopoly granted by a patent may be used to control an industry in a manner not considered in accordance with the public good and indeed in a manner which would be forbidden otherwise by the anti-trust laws.

The latter contention seems to have been overthrown by the recent decision in the bath-tub case (Standard Sanitary Manufacturing Company vs. United States) in which the Supreme Court decided that the patent right could not be extended to control the output of this industry.

The right to determine the resale price has apparently also been upset by a decision of the United States Supreme Court on May 26 in the Sanatogen Case, (Bauer & Cie and Bauer Chemical Company vs. James O'Donnell). The Supreme Court there decided that it was not infringement of the patent for the retailer to sell the patented article at a price different from that fixed by the license accompanying the original sale by the owner of the patent. This interpretation of the law cannot, however, be regarded as fixed and permanent, since it was rendered by a court divided five to four, and is apparently in conflict with the decision handed down in the mimeograph case (Henry vs. A. B. Dick Company). The court was in the latter case also nearly equally divided, the decision being rendered by four justices out of the seven sitting in the case. Since these same four justices dissented in the Sanatogen Case, the attitude of the court, and consequently the interpretation of the law, cannot be regarded as fixed. Legislation establishing definitely the extent of the monopoly conferred by a patent seems, therefore, desirable.

We will now consider the Oldfield Bill more specifically. This bill has the following aims:

(1) To prevent procrastination by applicants for patents by limiting the period of the patent monopoly to 19 years from the date of filing the application, exclusive of the time consumed by the Patent Office or the courts in considering the application.

(2) To prevent suppression of patents by providing for compulsory license under certain conditions. These conditions are aimed to protect the inventor who has been unwillingly delayed in making use of his patent and is not purposely preventing its development.

(3) To prevent action for infringement because of a breach of contract of sale or breach of license when these are not directly covered by the patent itself.

(4) To prevent the use of a patent to restrain or monopolize trade, except in articles definitely covered by the patent. It provides that any patent so used may be condemned and forfeited.

(5) To define and enumerate practices in connection with patented articles which shall constitute infractions of the Sherman Anti-Trust Law.

We will consider these aims in detail.

(1) Your Committee approves the provision contained in Section 1 of the Oldfield Bill, for limiting a patent to 19 years from the date of filing the application, exclusive of the time consumed by the Patent Office or courts in considering the application.

(2) Your Committee does not favor a system of compulsory licenses. We agree that the suppression of patents developed by competing inventors or companies through buying up by one individual or corporation for the purpose of preventing development is objectionable. This, however, is a very rare occurrence, but one instance (Paper-Bag Case—Continental Paper Bag Company vs. Eastern Paper Bag Company) having been brought to our attention in any of the literature of the subject. Moreover, many patents having the same objects in view are frequently developed by the same inventor or company. These patents may be regarded as alternative and there is no object in prosecuting any of them except the one which proves most suitable for the purpose. If any provision for compulsory license should be enacted by Congress, it should exclude such cases and should apply only to basic patents which have been independently invented or developed. The compulsory license system is in effect in Germany, France and Canada, and has not been productive of any notable results. It is authoritatively stated that in Germany no compulsory license has ever been issued. Even with appropriate restrictions, we believe a provision for compulsory license would have little effect other than to open the door for expensive litigation, since it might be used as a cloak for harassing inventors who are legitimately aiming to work their patents, and for this reason we believe it would be better to avoid all legislation in this direction.

(3) We believe the monopoly of the inventor of the patented article should be complete within the period of the patent insofar as it applies only to the subject of the patent. We believe that this monopoly should cover the control of commerce in the article even to the extent of fixing the retail price, even though under the decision of the Supreme Court above mentioned this right cannot be regarded as attached to a patent at the present time. If this right be established by new legislation it should be equally applicable to copyrights and articles not covered by patent grants, since we feel that all the arguments in favor of fixing retail prices apply as fully to unpatented as to patented articles. Regarding other license restrictions, we favor limiting the issue of injunctions against infringement to those license provisions which apply only to articles covered by the patent itself.

(4) We consider this purpose sufficiently covered by the last paragaph.

(5) We consider the injection of provisions pertaining to anti-trust legislation out of place in a patent law, and we consider these provisions particularly odius since they would apply to patented articles legislation upon this subject from which unpatented articles would be exempt.

From the above detailed discussion it is evident that there is but one provision of the Oldfield Bill to which this Committee can subscribe, and we feel that even if any of the other provisions of this bill are finally incorporated in a statute they should be entirely revised, since this bill is not well worded and does not provide the limitations with which any radical changes in legislation should be hedged.

Regarding other changes in the patent law and administration, your Committee offers the following suggestions:

The new rules promulgated by the Supreme Court of the United States, which took effect in February of this year, are aimed to correct some of the abuses which formerly attended patent litigation by making witnesses subject to cross-examination, by requiring testimony to be taken in court, except when both parties otherwise agree, and by subjecting the testimony in these cases to the same rules of evi-

dence commonly in effect, thus excluding irrelevant and otherwise objectionable testimony. These rules, if applied in the proper spirit, should greatly reduce the expense and time for which patent cases were heretofore notorious, and we feel that any legislation governing this procedure should not be enacted until it is seen how well these rules work in practice.

We urge the establishment of a single court of patent appeals to consider patent cases alone and have final jurisdiction.

We favor greater liberality upon the part of Congress in appropriations for the Patent Office, so that the work of this office may be perfected to the end that a patent when issued may be regarded as valid until decided through adjudication to be invalid.

Above all we favor the appointment of an independent nonpartisan commission to make a thorough study of the entire patent situation and its needs, and investigate the operation of the patent systems in use in other countries, and report to Congress before any legislation whatever is passed upon this subject.

English Standardization Rules.

The Council of the British Electrical and Allied Manufacturers' Association adopted provisional standardization rules at a meeting last April. Some of the features of these rules will be of interest, especially in relation to the proposals now under consideration for the revision of the Standardization Rules of the American Institute of Electrical Engineers.

The standard frequencies are 25 and 50 cycles.

Two classes of rating are recognized —continuous rating and short-time rating. The latter is defined, as the output with which a machine will go for one hour or other specified period and comply with the regulations. Machines with two or more fixed speeds are to have a definite rating for each speed. Guarantees as to heating, efficiency and other characteristics are to be taken as applying to tests at the pressure marked on the nameplates: motors must be capable of operating without injury at their rated outputs and overloads on pressures within five per cent of the rated voltage, high or low.

Machines with unobstructed ventilation are permitted a temperature rise of 40 degrees centigrade by thermometer in windings and cores; and 55 degrees in commutators and slip rings. In totally inclosed machines the latter rise of temperature is permitted in all parts. In transformers the allowable temperature rise is 50 degrees. In machines intended for service at high altitudes the permissible rise, tested near sea level, is to be reduced 2.5 per cent for each 1,000 feet of elevation.

Machines with continuous rating, with temperature rise at full load in accordance with above, are to be capable of withstanding 25 per cent overload for two hours, if above 100 kilowatts in capacity. This period is graded for smaller machines down to five minutes for capacities of two kilowatts or less. Totally inclosed machines are excepted from this overload provision.

Motors with short-time rating are to be capable of carrying an overload of 100-per-cent torque for 30 seconds.

Transformers are to be capable of withstanding overloads of 25 per cent for two hours and 100 per cent for 30 seconds.

A Comparison of Arc and Spark for Radiotelegraphy.

It has been claimed by the users of continuous oscillations in radiotelegraphy that these waves are less absorbed in passing over the surface of the earth than the damped wave trains produced by spark sending. Several attempts have been made to settle this question by experiment, but over the moderate distances employed no difference in absorption has been observed. In order to extend these experiments to greater distances, a 30-kilowatt arc operated with 500-volt direct current was installed at the high-power station at Arlington, Va. At a wave-length of 4,100 meters, the arc gave an antenna current of from 47 to 53 amperes. Comparisons were made of the received current from this arc and from the 500-cycle spark set giving from 100 to 120 amperes in the antenna, by L. W. Austin, of the United States Naval Radiotelegraphic Laboratory, and described in the *Journal of the Washington Academy of Sciences.* A very careful set of observations of the received currents from the two types of apparatus was made at St. Augustine, Fla., the measurements being taken by the calibrated detector and galvanometer method. The distance between the two stations was 530 nautical miles.

The received currents were found to be simply proportional to the radiation currents at Arlington with an error not greater than 10 per cent; that is, at this distance there was no evidence of a difference in the absorption. These results were verified by the shunted-telephone method using the slipping-contact detector, at New Orleans and also at Key West, both places being approximately 900 miles from Washington.

The receiving apparatus was then placed on the *United States Ship Arkansas* and taken to Colon, 1800 nautical miles from Arlington. During the two days available for observation at Colon the receiving apparatus was taken to the Naval Radiotelegraphic Station. During these two days, the arc signals were heard at each schedule both day and night, while the spark signals were heard only at night. These observations indicated that at 1,800 miles the continuous waves show a smaller degree of absorption than the damped waves. It was not possible, however, to draw this conclusion with certainty, since at the season of the year in which the observations were taken, late December, exceptional days occur which might perhaps affect the continuous oscillations in a different manner from those of the spark.

An additional series of observations has been made during the recent voyage of the *Salem* to Gibraltar and return. Here it was found, in verification of the Colon experiments, that for distances over 1,400 miles the arc as received in the day time was equal to or somewhat better than the spark, notwithstanding the fact that the spark radiation current at Arlington was considerably more than twice as great as the corresponding arc current. Messages were continuously received with both arc and spark in the day time up to 2,100 miles. Several times day signals were heard at greater distances, the arc being uniformly louder. The night signals were heard all the way to Gibraltar.

Engineering Positions Open.

In connection with the valuation of the property of the railroads of the country to be undertaken by the Interstate Commerce Commission a large number of engineering positions are to be filled. The United States Civil Service Commission has announced competitive examinations for electrical engineers to take place on July 21 and 23 at the usual places. From the eligibles, appointments will be made as electrical engineers at salaries ranging from $1,080 to $1,500 per annum, and as senior electrical engineers at salaries ranging from $1,800 to $4,800 per annum.

Senior electrical engineers will be rated upon the evidence adduced as to their general and technical education and training and their practical experience. Applicants will not be assembled for examination. Applicants must be at least 25 years of age.

The examination for electrical engineer will cover practical questions on electrical engineering, mathematics, pure and applied mechanics, etc. Credit will also be given for education, training, experience and general fitness. Three years' experience is a pre-requisite and applicants must be 23 years of age. Application Form 2039 should be obtained from the Civil Service Commission, Washington, D. C.

ELECTRIC-GARAGE EQUIPMENT AND MANAGEMENT.[1]

H. M. Martin.

If one were given carte blanche to design a perfect electric garage it would seem, off hand, to be a comparatively simple matter. Doubtless many automobile problems are now difficult; yet there is much food for thought, and many compromises have to be made before the ideal design can be adapted to working conditions.

Simplicity and cleanliness are the electric's prominent characteristics, and these ideas can be exemplified in an electric garage which will be complete in every detail, and yet be in strong contrast to the more elaborate equipment, and larger space necessary to garage and repair gasoline cars. Just at the present time electrics are enjoying a certain prominence before the public, and justly so, because of the increasing cost of gasoline and the decreasing cost of charging current. As far, though, as the price of fuel is concerned, it would be well to take the utmost advantage of this situation while it lasts, since probably the near future will see the successful introduction of a fuel heavier even than the present liquid that is by courtesy called gasoline. But this is a digression.

The location of the garage should be central with regard to the places of business of its customers. Since customers are not usually promised in advance, other conditions assume greater importance. If possible, it should be on a well paved street near a main artery of travel, and here we strike the first necessity for compromise, since property of this description will probably be too expensive. If there is any choice in altitude the lower should be chosen, in other words, at the foot of a hill rather than at its summit. For the same reason, the ground floor should be only an inch or so above the sidewalk or street level.

This brings us to the building itself. The number of floors will be determined by compromise between the cost of ground and the cost of additional vertical construction with all that that implies, elevators, etc. Particularly if there are many floors, the elevators (of which there must be at least two) will be of as high a speed as good judgment will allow, because on the elevators' speed will depend the number of cars that can be accommodated. This is true because of the fact that in a commercial garage practically all the cars have to leave the building between 6:30 and 8 a. m. With three men to an elevator working lively, but not to the point of danger, it takes from 20 to 30 seconds to move a car on and off. If the average floor is 60 feet from the ground floor, it means that to get one car down every minute and a half, the elevator must run at a speed a little better than 110 feet per minute. This is all right for small cars, but if larger ones up to five tons have to use the same elevator, then an automatic device should be installed cutting out resistance in the elevators motor's shunt field, and reducing the speed to about 60 feet. In this way the apparatus itself takes care of increased load.

Electric control from the car should, of course, be employed instead of the usual hand rope. The electric control precludes the possibility of starting the elevator by anyone not on the platform itself. Automatic gates will prevent, nine times out of ten, the serious accident of having a car fall down the shaft. This usually happens when the platform has been moved without the knowledge of someone about to back a car upon it, and who sees his error too late. If the car is pushed by hand, or very slowly under power, a comparatively light barrier will stop it, but if it has attained any considerable speed it is doubtful whether any of the devices at present in use would not bend out of their guides and become useless.

It is preferable to have no posts to interfere with the free movement of cars, though to leave them out will add materially to the initial expense and make the floor thicker, and the whole building higher. If posts must be used, let them be spaced with regard to the number and sizes of cars that are planned to stand between them. They should be provided with baseguards, which will prevent damage to projecting parts of the vehicle. Wall guards are equally important, so placed that the tires will strike them before any part of the car can hit the wall.

Concrete floors should be painted with a preparation giving them a smooth surface which is easily cleaned and saves the concrete from wear, and gritty dust from rising. These floors should be pitched slightly from the center line down to the side walls, both ways, with gutters formed in the concrete along the walls so that washing may be done, if necessary, without moving the cars.

Lighting should be well distributed, and each floor's lights controlled in several groups for the sake of economy of current. Around the walls, at frequent intervals, receptacles should be installed for drop cords so that these need not be of an unhandy length. The wall receptacles should be of sufficient capacity to take care of a portable drill.

Large windows are a good feature, and should be placed to allow the maximum of light and ventilation. This means a high window, which has other advantages.

The heating system should be ample to keep all floors where cars are stored, up to at least 60 degrees during the coldest weather. This is essential in order to start the batteries out warm. A gasolene garage can get along with any temperature above 32 degrees, but not so with an electric.

The charging equipment, switchboard, wiring, etc., should be of approved type, solid and well erected. This apparatus is so standardized that no special remarks are necessary except to suggest that rheostats, being usually grouped as closely together as their frames will permit, should be ventilated in summer. I know of a number of switchboard rooms that are intolerably hot during the warm months. In addition to this, charging plugs should be suspended in such a way that when dropped they will not strike the floor. Local conditions must decide whether, if several floors contain vehicles to be charged, one switchboard shall control them all, or whether each floor shall have a separate one. Ventilation should also be well looked to in the battery repair room, for here batteries are often gassing for a day or more on their initial charge. The floor of this room demands special attention, acid proof brick or tiles laid in pitch being the best construction. It is of the utmost importance that the drainage system from this department—the entire distance to the sewer—should be either of lead or glazed earthenware, and preferably run as "open plumbing," not buried in the walls.

A small machine-tool equipment is a very useful adjunct in an electric garage, even where most of the work is sent out. A lathe, drill press and emery wheel will do most of the odd jobs that come up from day to day. A more complete equipment would include a shaper, milling machine, and power hack-saw. If the garage is to be complete to handle everything that may become necessary, it should include well equipped carpenter and paint shops. There is much to be said in favor of this, since then a car need never leave the garage except for its daily work.

This brief review of the physical characteristics of the garage has touched only the high spots and has purposely left out many details, each of which should have painstaking thought bestowed upon it; for the smooth and efficient operation of the plant will depend in a large measure on the wise forethought of its designer.

Now as to management:—In the first place, let there be one head to the entire system. If it is possible (and it ought to be nowadays) to combine in-

[1] Paper read before the Electric Vehicle Association of America, New York, May 27.

one person business ability and a thorough technical knowledge of the industry, then this is the desideratum. If not, then let the head be by choice a good business man, with a broad enough mind to know his limitations in other fields, and to trust his well chosen technical subordinates. Many failures in management have resulted from trouble between executives vested with coordinate powers; or again where large stockholders have held office with no qualifications for office holding other then stockholding.

From the head, direct lines of responsibility should radiate down to the most unimportant employee, so that each one shall know the scope of his work and its relation to the next move in the daily cycle of events.

There are a number of important questions that come up for decision almost daily in the operation of a garage. For instance, shall the customer be billed for accidents which may have been preventable? A chain comes off because a strut rod loosened. A controller finger burns, or freezes (as the case may be) because the contact was rough. A chauffeur is arrested and fined for having no tail light, the bulb being burned out. You will note in all these cases that there is room for argument since it is possible to say that a perfect inspection system would not have allowed the accident to occur. There are some garage managers, I am afraid, who regard such accidents as those just mentioned in the light of "Acts of Providence" especially provided to furnish them a source of revenue. In general it may be said that a public garage cannot afford to have as many really preventable accidents as a private garage can. That is, a public garage will suffer in its standing among others, and get a bad reputation if too many accidents happen. A customer whose single car is unwarrantably laid up for half a day will naturally make no end of a row about it, for, aside from the extra expense, all his plans for the day's work are upset. Perhaps I can state the case more tersely by saying that breakdowns in the case of a private garage, may, up to a certain limit, cost less than the inspection necessary to prevent them, where as in a public garage very few strictly preventable accidents can occur without unfavorable comment and possible loss of business. This is not intended to justify preventable mishaps in either case, it is only a comparison of results. In point of fact, it takes only a very few accidents to equal the cost of a system adequate to prevent them.

Another question is, just what repairs shall be included in the flat monthly rate. Minor adjustments are conceded without extra charge, but there are a number of repairs that become necessary from time to time that hardly come under this head. An owner asks to have his smashed tail light straightened out, or new licenses put on, or perhaps says: "Just lend me a bell, or a spring, or an armature (as the case may be) until mine is repaired." The "just" indicating that he does not expect to be charged for the service. Sometimes it is hard to decide just how far generosity can be stretched, but as a rule I may say that it all depends on the customer's record. Of course old cars require a lot more in the way of incidental repairs than those of recent years, and to do any free work on them that should be charged encourages the owners in keeping them going. If I am creditably informed, there is at least one manufacturer of electric commercial cars who always scraps an old car of its own make when taken in trade, instead of giving it a coat of paint and selling it again. This policy is much to be commended since it rids the electric-vehicle world of an undesirable citizen, and raises the average of efficiency of the cars that are running.

At the present rates charged for garaging the small cars are the ones that pay the dividends. This is not because the rates are so far from equable, but because the small car on the average does not carry so large a proportion of its possible load as does the large one. A five-ton truck is chosen and purchased for certain work because that, and often a great deal more, is the load to be transported. But the light car is bought, perhaps, to replace a horse and wagon doing odd jobs, or with the idea of being up to date, or again with an eye to some advertising advantage.

In dealing with the owners of commercial cars, as a rule it is only the recent purchaser who is unreasonable and not willing to meet the garage management half way in the matter of disputes on bills or service rendered. A recent case is reported of a new car that ran to perfection for two weeks while operated by the factory demonstrator, and after he left was in constant trouble. The owner complained bitterly that his car was not being charged, and it was with great difficulty that he was finally convinced that the new driver was running the car with his brake set.

Most of the road accidents that can happen to electrics are easy to diagnose, and should cause the management no particular worry if the driver has had enough training to enable him to report the important symptoms. A few of the most common ones just as they come over the wire are as follows:—

1. My car was running all right, but stopped suddenly. Lights are O. K.

2. The same, but lights are out.

3. Car was all right up to fifteen minutes ago, when I noticed it was slow, now it will hardly crawl.

4. Car sometimes won't start,—helper has to push it. When it does go it bucks like a broncho.

5. No power on first or second notch, after that O. K.

6. No power on any but the last notch, and slow at that.

7. Motor seems to run O. K., but car does not move.

There are a dozen other combinations of these basic troubles, besides the usual run of mechanical failures.

In dealing with the owners of pleasure cars, considerable tact is required, rather than straight business acumen. A good many of these owners have no special interest in understanding the workings or limitations of their cars, and consequently there is no common ground on which an argument can be based. On the other hand, some owners consume a lot of the garage manager's time in arguments and explanations of "how it all happened." Both the commercial car manager and the pleasure car manager have all that they can do, but the first has the easier job.

Discussion.

Mr. Thompson brought up the subject as to what constituted legitimate charges by the garage. Tow charges were quite excessive in some cases and the owner might object on the ground that the breakdown was due to the improper care, inspection or repair of the garage people.

Mr. Harris inquired regarding the proper amount of time which should be spent by the garage in inspecting the machine. In one instance he knew of a case where the cost of labor for inspection was greater than that for repairs.

Mr. Roberts spoke of the loss of energy in the rheostats in the charging circuit. This loss was paid for by the owner of the machine and should in any case be made a minimum. The ventilation spoken of in the paper should be designed so that the heat carried off from rheostats was a minimum.

Mr. Thompson returning to this subject said that here was a matter for the manufacturers—viz: standardization. One was confronted with so many different numbers of cells in a machine—20, 24, 28, 30, 32, 40, 42, etc., that in charging there was so large a variation that there must of necessity be a loss of energy.

Mr. Nealey spoke of the rate of the cells and in this connection showed how the radius of action of an electric vehicle could be increased by charging at some period of the day at a higher rate than usual. A formula which gave a safe rate of "boost" was:

$$\text{rate in amps.} = \frac{\text{Charge in amp. hours}}{1 + \text{time available for boost in hours.}}$$

For instance suppose a 200-ampere-hour battery was half run down, a 100-ampere-hour charge would be necessary to fully charge. Suppose one could only afford to wait half an hour for this, then the safe rate to charge would be $\frac{100}{1+\frac{1}{2}} = 67$ amperes.

Mr. Sampson spoke from the standpoint of the garage company. How could the garage make the most money? By charging fair rates he thought. Regarding adjustments to vehicles he thought the charge should be determined by the time spent. A difficulty he had come across was the poor quality of paint on the cars. Grease could only be washed from some panel cars at the expense of the paint.

He remarked what a valuable asset a good driver was to the owner of a car and thought the association might profitably open some registry for qualified drivers.

A Unique Electric Street Light and Indicator.

A novel combined street indicator and light has been devised by a building company operating a short distance north of Los Angeles, Cal. This pretty monument also serves as a street and tract marker, a form of tract ornament which has, during the past two years, become quite popular in the Golden State. Since the marker fad started many of the owners of the tracts that have been subdivided have vied with one another in their efforts to present something new and unique in that line, and in many instances hundreds of dollars have been spent for these beautifiers in a single tract. These markers are composed of different materials and are erected in a variety of shapes. In some tracts concrete is used exclusively, in others stone, in some large timber, while in still some others a combination of two or three of the materials is effected. Much thought and study is given to the architectural work on these piers and gateways.

The marker described in this article is different from any thus far produced in Southern California, in that it works the entire 24 hours of the day. During the daylight hours the letters forming the names of the streets, which are located in the cap of the marker, are plainly visible, while at night these names are brightly illumined by means of an incandescent lamp which is placed inside the cap of the marker. In addition to being a street indicator the marker takes the place of the ordinary street lamp, doing away with unsightly poles. For this purpose an eight-inch opal glass globe is located on top of the cement cap and in this a 40-candle-power lamp is mounted.

The marker complete is 11.5 feet in height. The lower portion, which is composed entirely of brick of a dark red color with a clinker brick scattered here and there throughout the construction, is about 10 feet high. The base is 2.5 feet in width, while the top is 1.5 wide. A pleasing effect is added to this part of the marker by the mortar which is used between the bricks, this being of a dark blue color. Resting upon this brickwork is the hollow cement cap. This cap is two feet across and eight inches thick. The letters forming the names of the streets are three inches high.

A pleasing feature of this lighting system, which includes 40 markers and 80 lights, is that all of the wires used are run underground. Another novel feature is

Combination Marker and Street Light.

that all of the lamps of the system are controlled by a special clock or time switch which is located near the center of the system. At a certain hour each night this clock turns the lights on and when a given moment is reached the following morning the current is automatically cut off. The clock, the dial of which is about 12 inches in diameter, is situated on a telephone pole some 8 feet from the ground, where it is in easy reach of the attendant. The clock is of an unusually long-running type.

Although not an expensive marker, this is the most complete and one of the most beautiful in Southern California. In style it has a leaning to the old Spanish type, which is so popular in the Golden State at this time.

It is proposed to transmit electric energy to Paris from a hydroelectric generating station on the Rhone River at 120,000 volts. The distance is about 250 miles.

BOOK REVIEWS.

"Wiring Diagrams of Electrical Apparatus and Installations." New York: McGraw-Hill Book Company. Cloth, 253 pages (6x9 inches), illustrated. Supplied by the Electrical Review Publishing Company for $2.00.

This volume contains 439 illustrations with appropriate captions and without explanatory reading matter. It is a collection of circuit diagrams which should prove most valuable, since it represents fairly well all branches of electrical engineering except telephony and telegraphy and armature windings. Much information can be obtained from a study of these diagrams, since they will indicate more than mere wiring connections; they indicate the various methods of using apparatus and the proper arrangement of it. The various sections are devoted to generators, feeders, transformers, potential regulators, synchronous converters, batteries and boosters, substations, motors and speed control, distribution, lamp mechanism, rheostats and controllers, lightning arresters, measuring instruments, circuit-breakers, railway equipment and interior wiring.

"Electric Cranes; Their Design, Construction and Application." By H. H. Broughton. London: The Electrician Printing & Publishing Company, Limited. Three-quarter leather, 811 pages (6x9¼ inches) illustrated. Supplied by the Electrical Review Publishing Company for $9.00.

This is a very comprehensive treatise upon the subject and is intended to be the first volume of a complete manual of lifting and hauling machinery. The subject is treated from the mechanical rather than the electrical side, the questions of design being gone into rather deeply and the mechanical construction of the various types of cranes being considered in detail. The volume is profusely illustrated with examples of cranes of various types and consideration is given to American and Continental cranes, as well as those of English make, although the author is lecturer in a technical college in England. It must not be inferred from the above, however, that the electrical portions of the subject have been neglected, for the electrical equipment has received detailed attention and not only are motors considered but also resistances for the control mechanism, electromechanical brakes, electromagnets, etc., are discussed. Typical wiring diagrams are given for the motors, controllers, etc. The mechanical equipment, however, occupies the bulk of the volume. The next to the last chapter is devoted to specifications and this should be helpful not only to consulting engineers and users but makers of cranes as well. Sample specifications are given to illustrate this discussion. There are a number of useful tables and many valuable data in the

book. The typographical work and binding are good, and there are nearly 600 illustrations, which are of a kind to lend especial value to the volume. The inclusion of advertising matter within the limits of the reading pages is a slight drawback. A good index has been appended.

"Electrical Instruments and Testing." By Norman H. Schneider and Jesse Hargrave. Fourth edition, revised and enlarged. New York: Spoon and Chamberlain. Cloth, 245 pages (5x7 inches), illustrated. Supplied by the Electrical Review Publishing Company for $1.15.

The main portion of this book is by Mr. Schneider, and describes the most common forms of electrical measuring instruments, illustrating particularly the commercial makes which are in general use in this country. The book is introductory in its character and will not take the place of more complete handbooks on measurements and testing. It will be useful, however, to the beginner in this work. This edition has been partly rewritten and includes some apparatus not comprised in the earlier editions and also some new tabular data, such as a copper-wire table. It is unfortunate that the name of a man so prominently connected with this work as Sir William Thomson should be repeatedly misspelled. The appendix by Mr. Hargrave takes up the testing of telegraph wires and cables and the location of faults upon such lines. This gives in a simple manner some of the important tests used by telegraph and telephone engineers.

"The Electric Motor and Its Practical Operation." By Elmer E. Burns. Chicago: The Joseph G. Branch Publishing Company. Cloth, 191 pages (5x7½ inches), illustrated. Supplied by the Electrical Review Publishing Company for $1.50.

This is a simple presentation of the principles underlying the electric motor and it is aimed to help the man in the shop or engine room who is not in a position to take up the study through the medium of a more extended treatise. Mathematics has been largely avoided and the use of vector diagrams entirely omitted. The treatment is simple and proceeds from the simpler experiments, which are easily understood, and which are copiously illustrated with line drawings. A few illustrations of modern machines are included. In the appendix is a list of machines used in various industries with motor drive and the necessary horsepower of the motor.

"Alternating Currents Simplified." By Elmer E. Burns. Chicago: The Joseph G. Branch Publishing Company. Cloth, 199 pages (5x7½ inches), illustrated. Supplied by the Electrical Review Publishing Company for $1.50.

This book aims to give in an elementary manner a clear understanding of the nature and behavior of alternating currents. Mechanical analogies have been very largely employed and indeed may seem in some cases to have been pressed rather too far, as for instance in the case of power-factor. It is rather unfortunate here too that the real distinction between power and wattlessvolt-amperes is not clearly brought out. Thus it is stated that the kilowatts are a certain fraction of the total power and this fraction is the power-factor. Such statements as this cannot do better than confuse the reader whose knowledge of the subject does not permit him to discern the misstatement. In general, however, the material is clearly and simply stated and should be helpful to the novice seeking a first introduction to the subject. In the appendix the resuscitation rules adopted by the National Electric Light Association are given.

"Experimental Wireless Stations." By Philip E. Edelman. Minneapolis: Philip E. Edelman. Cloth, 224 pages (5¾x7¾ inches), illustrated. Supplied by the Electrical Review Publishing Company for $2.00.

This book is concerned principally with a description of the apparatus suitable for an experimental station for the wireless-telegraph amateur and its construction. The author, who has had considerable experience in this work, has performed his task well and anyone desiring to initiate experiments along this line with the object of attaining proficiency in wireless work will find the book valuable. Complete dimensions are given for the construction of various pieces of apparatus essential to a wireless station, and these are supplemented with tables containing data for the construction of spark coils, transformers and other common pieces of apparatus. Theory is not taken up to any considerable extent, although explanations of the apparatus and the general principles of wireless are given. The experience which can be obtained with such an equipment as the author describes would fit an industrious experimenter for a regular position as wireless operator, a field in which there are at present many openings. Care is taken in the book to comply with the requirements of the wireless regulations which have been put in force by the federal Government. The rights of the experimental station under this law are stated. The illustrations in the book are line drawings, no attempt having been made to give half-tone reproductions of apparatus.

"Foundations and Machinery Fixing." By Francis H. Davies. New York: D. Van Nostrand Company. Cloth, 146 pages (4x6 inches), illustrated. Supplied by the Electrical Review Publishing Company for $1.00.

This book fills a gap in the literature of power-house construction, since very little has been published along the same line. It takes up the subject of foundations for engines and other machinery and considers it in a very practical way, giving a large number of data for machines of different types, speeds and horsepowers with, in a number of cases, the costs thereto. As these figures are probably taken from English practice it is a question how well they will apply in the United States, especially when one considers the variation in prices from time to time. The various chapters consider the functions of foundations, their materials, excavation and construction, and methods of anchoring. The question of vibration is taken up and studied with reference to its causes, effects and possibilities of elimination. The last chapter is devoted to the mounting of electric motors. The illustrations are of a practical nature and help to elucidate the methods described by the author.

"The Art of Illumination." By Louis Bell. Second edition, revised and enlarged. New York: McGraw-Hill Book Company. Cloth, 353 pages (6x9 inches), 171 illustrations. Supplied by the Electrical Review Publishing Company for $2.50.

Dr. Bell is a recognized authority upon this subject and the new edition of his book has brought the earlier presentation up to date and added considerable material relating to the most recent practice. His book deals with the means of illumination rather than with the scientific end of the subject and presents the physiological as well as the physical aspects of the art. Particular stress is laid upon some of the points which are now receiving special consideration from illuminating engineers, such as the necessity of shielding the eye from the source of light, the effect of reflecting surfaces, such as the walls of the room, upon the effects obtained, and the desirability of obtaining uniform illumination of reasonable intensity rather than intense illumination at some point with a corresponding feebleness in others.

Electric Lamp for Automobile Radiator.

An electrical engineer devised a good scheme to keep his automobile radiator from freezing in winter. During the cold weather he keeps a 16-candle-power lamp burning inside the engine hood while the machine is standing in the garage. Not only does it prevent freezing, but it keeps the engine warm so that it can be easily and quickly cranked.

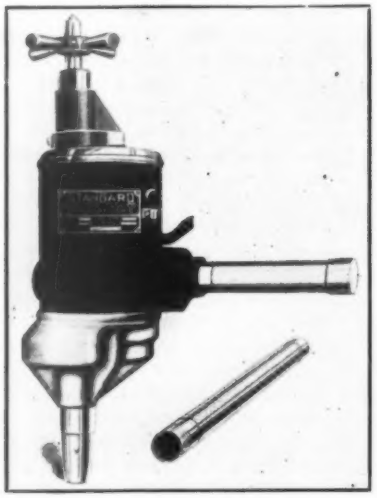
The high price of gasoline is attracting attention throughout England, especially in London. This is advantageous to the sale of electric motor cars, and it is evident that they are coming into extensive use for shopping, calls, the theater, and drives about town.

New Electrical and Mechanical Appliances

New 1.25-Inch Portable Electric Drills.

The Standard Electric Tool Company, Cincinnati, O., has developed, and is now placing on the market, two types of portable electric drills with 1.25-inch capacity in steel. One is a universal type that operates on both alternating and direct current and the other is for direct current only. These are in addition to the previous standard lines of various sizes, ranging from one-fourth to seven-eighths inch, which were illustrated and described in these columns in former issues.

In these new tools the special mechanical features are: ball bearing throughout, absolutely oilproof motor, and unit construction. These features are entirely of new design and construction in the manufacture of portable electric drills. All gears are steel generated in Fellows gear shaper.



Portable Electric Drill.

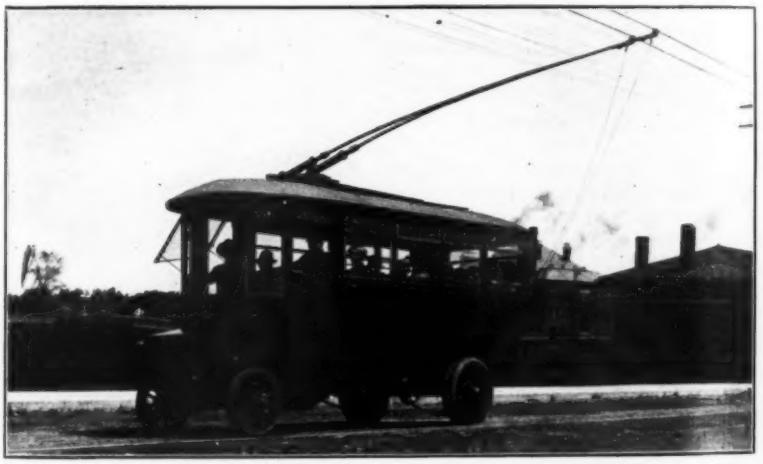
The electrical feature is a very powerful motor, constructed so as to withstand abuse and hard use to which machines of this kind are subjected, and at the same time to maintain the highest electrical efficiency. Series motors are employed throughout.

These machines are of very simple construction, being made up of only five simple units, which may be dismembered for inspection without disturbing any of the electrical connections.

Trackless Double-Trolley Bus for Merrill, Wis., Railway System.

The Merrill Railway & Lighting Company, of Merrill, Wis., contracted with the Field Electric Bus Company, 135 Broadway, New York City, some months ago to build for it a trackless trolley bus after the style of those which have been successfully introduced in England and on the Continent during the past few years, descriptions of several of which have appeared in this journal. The Merrill bus has been delivered and is now in successful service, as is shown by the illustration herewith.

The bus is of the forward-entrance, pay-as-you-enter type operated by one man that acts both as motorman and conductor. It is of the same general design as the line of buses furnished for Carson, Pirie, Scott & Company, Chicago, and which were described in our issue of April 6, 1912, except that it is not equipped with storage batteries, but instead of these receives power through two separate trolley poles bearing against the adjoining positive and negative trolley wires. These trolley poles are very long and have a patented type of swivel harp and base, the construction being such as to give the bus freedom of lateral movement of 10 to 12 feet on either side of the trolley wires, thus easily passing other vehicles or obstructions on the street.



Trackless Trolley Bus.

A 500-volt, 12-horsepower series motor is provided, together with a five-point resistance-type controller. The motor drives by universal shaft and bevel gear to a jack shaft with differential and from there to the rear wheels by chains, as is shown in illustration, making a very efficient drive. The bus has two sets of brakes of liberal size with equalizers. It accommodates 18 passengers very comfortably and its long flat springs and solid rubber tires give it an easy riding quality. The length of the bus is 18 feet 6 inches over all, its width is 6 feet and its total weight is about three tons.

The Merrill bus is believed to be the first practical one of the trolley type used in this country. Its route is about 4,000 feet in length and includes a long bridge and three steam-railroad crossings. The bus forms an economical feeder for the railway system with which it connects at one end of its route, since the heavy first cost and upkeep of track construction with so many crossings would not have been justified on the traffic now available.

The Field trolley bus at Merrill has worked successfully from the start, after the proper adjustments had been made on the trolley poles, harps and bases, which it had not been possible to test at the factory. Although not yet in operation for a long time it is expected that the operating and maintenance expenses of the bus will be

about the same or lower than those in England which have been on the best systems about 10 cents per car-mile. It is expected that the bus will effect a saving of something like 3.5 cents a car-mile over what the cost would be with a regular trolley car. It is planned to extend the bus system to other feeders of the railway in different parts of the city and also into the country, because the small investment required, the flexibility and mobility of the system and the low operating and maintenance expense mean greater return to the investment than is possible with any regular street-railway system until considerable density of traffic is assured.

New Magnetic Disk Brakes.

Accessibility of parts is the prominent feature in a new line of magnetic disk brakes recently put on the market. With the multiple, disk brakes now in service there is no way of removing and replacing the disks without practically dismantling the brake and removing it from the motor shaft. This is because the disks are taken out from the top so that first the magnet winding must be removed, the brake slid free of the shaft, and the disk-case top plate removed, before the disks themselves became accessible. With the new line of brakes, one of which is shown in Fig. 1, the mere loosening of the three bolts which secure the magnet coil in place gives access to the disks which can be slid out of the case along the shaft. No other work is necessary.

Ventilation is also secured for the first time in multiple-disk brakes. The

Fig. 2—Ventilating Outlets.

Through this ventilation are secured better capacity and wearing qualities. No lubrication is needed and an absolute minimum of attention is required.

Magnetic-disk brakes are selected more or less by guess, because manufacturers give nothing but a horsepower rating which is rather indefinite, as the size of brake depends to a great extent on other factors of service. To eliminate this guesswork and allow the selection of the proper size brake for all cases the new brakes are rated in horsepower, maximum torque in pounds-feet, and capacity in foot-pounds per minute. For different kinds of service such as for crane hoist or screw-down of a rolling mill, etc., the brake best suited can therefore be selected.

Structurally considered, these brakes, which are made by the Cutler-Hammer Clutch Company, of Milwaukee, Wis., consists of a hub, a series of stationary and rotating disks, an inclosing case, a spiral spring and an electromagnet. The hub, which is mounted on the shaft, carries the rotating disks. These are interleaved between the stationary disks which are anchored to the inclosing case. The stationary disks are faced with a patented product having a high coefficient of friction, and the rotating disks have internal radial air passages. Normally, the stationary and rotating disks are pressed into frictional engagement by means of a spiral compression spring. The electromagnet serves to compress this spring and release the pressure on the disks when it is desired to release the brake. The intensity of the braking force can easily be adjusted, and brake application and release are made without shock or hammer. The actuating forces being balanced within the brake, there is no end thrust imposed on the shaft to which they are attached.

The friction linings on the stationary disks are made from a patented product consisting of a weave of asbestos and brass wire, and are riveted to the stationary disks by countersunk copper rivets. The material of these linings has been chosen on account of its superior wearing and braking qualities, determined by a comprehensive series of tests. The same method of thorough impregnation of the magnet coil that is used in the construction of Cutler-Hammer lifting magnets is employed in the case of all brake coils. This insures them against grounds or short-circuits.

Fig. 1—Magnetic Disk Brake—Magnet-Case End.

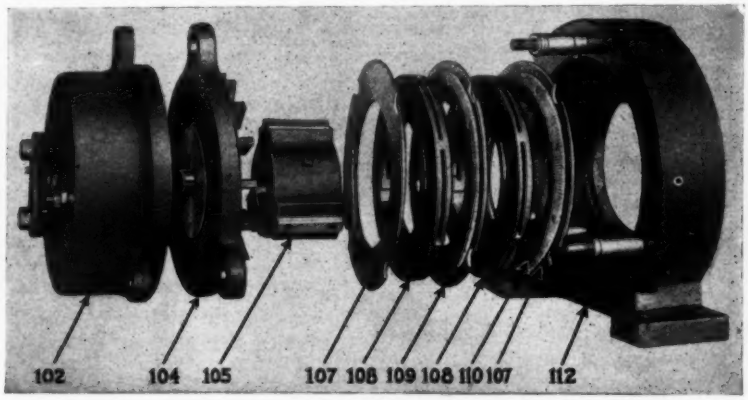


Fig. 3—Exploded View of Disk Brake.

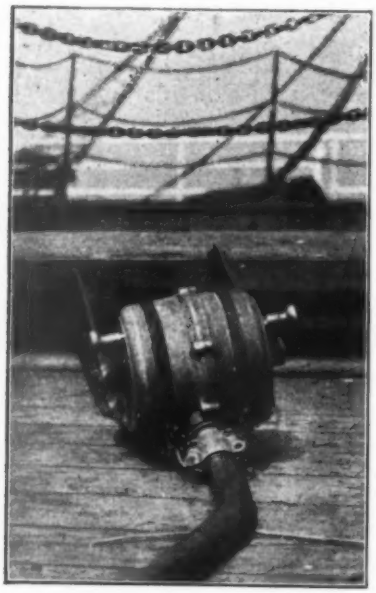
rotating disks shown in the exploded view, Fig. 3, have cored radial passages similar to those in the runner of a centrifugal pump. When set in motion, air is drawn in through inlet passages in the hub and ejected from outlets provided in the side of the disk-inclosing frame under the cover.

New Method of Remote Control for Electric Cranes.

A new method of controlling wharf cranes has recently been introduced on the docks of the Manchester Ship Canal, and at other points in England. Heretofore traveling cranes which have been used for loading and unloading vessels at the dock have been operated from the cab of the crane. From this position it is quite impossible for the operator to see what is taking place in the hold of the vessel, and he has had to depend on signals from a man standing at the hatchway to indicate whether hoisting or lowering

was necessary and, in fact, for the entire manipulation of the crane. As a result of this second-hand operation, it has many times happened that serious injury to goods or to persons has occurred with considerable loss to ship and dock owners for damages sustained. It was a knowledge of these facts that brought into existence the Holme crane controller. The controller itself is a very small, light and compact affair, weighing but six or eight pounds, and is suspended from the shoulders of the operator who stands in an advantageous position as regards the work being handled.

The controller is circular in form with a push switch located at the top normally pulled out or up. In an emergency to stop either lowering or hoisting it is only necessary for the operator to hit the knob of this push switch, forcing it downward. This operation brings the crane motor immediately to a stop. The raising or lowering operations are controlled by a lever at the right-hand end of the controller, while the swinging of the boom either to right or left is accomplished by a similar lever on the left-hand of the controller. The connections of the controller are through a flexible cable, steel armored, the electrical connections passing up through the center post of the crane, and into the cab. Current is taken through sliding contacts mounted on the center post inside the cab. This construction provides for great flexibility of movement vertically which has been found necessary in actual operations. The apparatus in the cab is very simple, being a series of small single or double-pole contactors, which may be placed in any out-of-the-way place available, and



Near View of Crane Controller.

Mr. Holme Demonstrating the Use of His Crane Controller.

a series of cast-iron grid resistances, which may also be located at any advantageous point. In addition to this there is a solenoid brake attachment, this feature being one of the most important. The whole equipment can be applied to any existing electric crane and without in any way disturbing the original arrangement. It has proved very effective and economical, and is now in use in approximately 100 installations in Great Britain, and is being rapidly adopted by many concerns using electric cranes in which remote control is desirable. It effects a very material economy by reason of the fact that the wages of one man, who was formerly required for signaling, are being dispensed with, besides entirely eliminating loss and damage due to injury to goods or persons.

These controllers are manufactured by Bertram Thomas, Limited, Manchester, England.

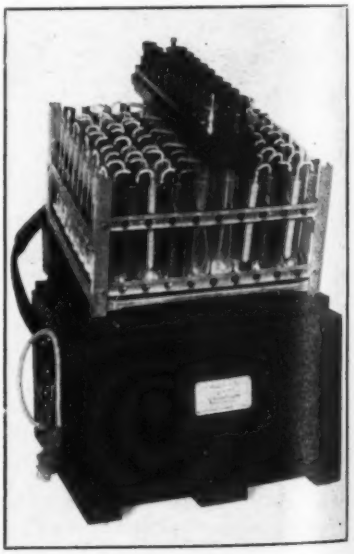
Marcuson Portable Testing Battery.

The portable testing batteries manufactured by E. Marcuson, 136 Liberty Street, New York, were described in our issue of February 12th, 1910, and the illustration in that article showed the standard type of battery having a commutating switch for connecting the two sections in series or in parallel, a spring clip being provided for the purpose of tapping voltages other than those obtainable by means of the switch.

Where it is desired to have a number of different voltages available at the terminals, batteries are now furnished with a special type of switch which eliminates, to a great extent, the use of the tapping clip, thereby facilitating the change from one voltage to another. A battery having one of these improved commutating switches is shown in the accompanying cut, which is from a photograph of a 160-volt battery made especially for the Edison Electric Illuminating Company, of Boston. The 80 cells in this battery are arranged in 10 equal groups, each giving 16 volts. By means of the switch, any or all of the ten sections may be connected to the two binding-posts in any manner desired. By placing the switch arms in the proper positions, the following voltages and combinations, among others, can be obtained: 16, 32, 48, 64, 80, 96, 112, 128, 144, 160 volts, 80 volts multiple-series and 16 volts multiple-series. The spring clip shown in the illustration attached to the side of the box, may be used for tapping within any section.

The switch is very compact and extremely simple in construction, consisting merely of a number of rotating arms, each arm being one end (positive or negative) of a section. The arms are disposed in two parallel rows on a hard-rubber switch base, all the positive arms being in one row and all the negative arms in the other. Each arm can swing so as to make contact with the neighboring arms of either positive or negative polarity.

The illustration shows the antimonial-lead crate, which constitutes the nesting for the small storage cells, removed from the containing box. All parts of the battery are visible, accessible and removable and, it is claimed, with reasonable care the elements will last a number of years. These batteries are useful, not only as portable outfits, but also for the laboratory.



Testing Battery.

Pole-Type Feeder-Voltage Regulator.

With the large electrical distribution systems of the present day, the outlying feeders usually extend far beyond the point where it is practicable to maintain constant voltage by apparatus in the central station or by feeder-voltage regulators in the substation, resulting in unsatisfactory service to the consumers residing in such localities. Up to the present time, the apparatus for voltage regulation has been limited to the indoor type, the installation of which at remote points would necessitate building substations, this in many cases making the expense of installation prohibitive.

The General Electric Company has just placed on the market an automatic regulator for outdoor service, and which is so designed that it can be installed on a pole or in any other convenient place.

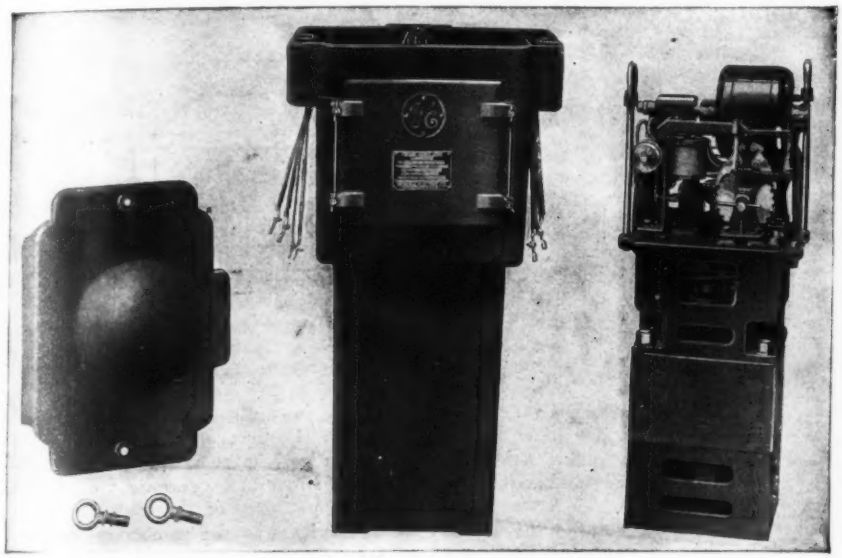


Fig. 1—Regulator Removed from Tank.

This regulator is designed for single-phase, 60-cycle circuits to give 10 per cent boost or lower where the power of the feeder is to be regulated does not exceed 25 kilovolt-amperes.

The regulator consists of the following essential parts: cores and coils, operating motor, operating mechanism, voltage relay, tank.

The regulator is of the well known induction type and has two windings arranged on separate iron cores, one, the primary or shunt winding, being connected directly across the circuits, while the other, or the secondary winding, is connected in series with the line. The primary core with its winding is so constructed that it can be rotated within the core of the secondary or stationary coil, so that the effect of its flux upon the secondary coil may be varied, causing the voltage of the feeder to be increased or decreased. The regulator is of double-pole design, and the rotor is therefore arranged to be turned through a range of 180 degrees.

The movement of the rotor is obtained by means of a small single-phase motor, which is kept running continuously. This motor is normally

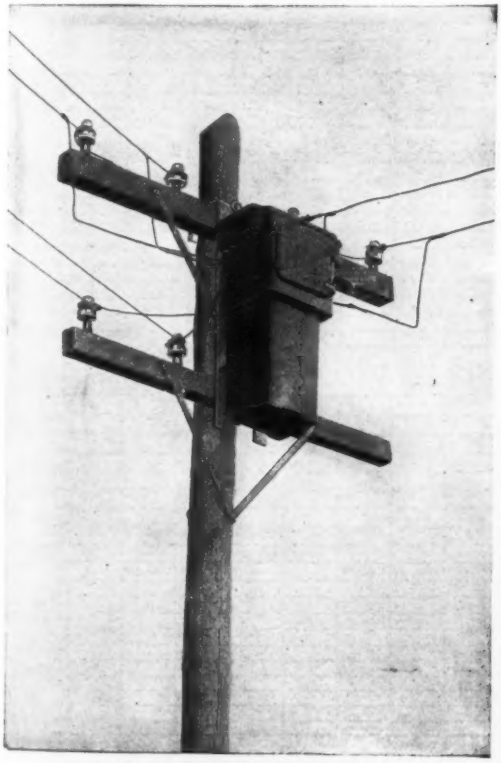


Fig. 2—Regulator in Service.

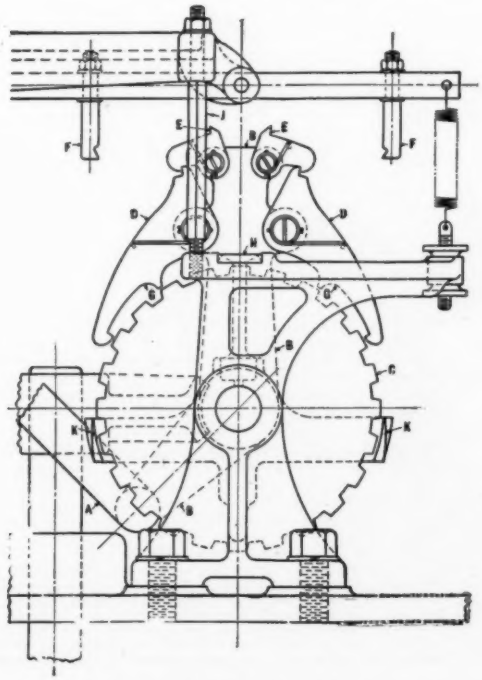


Fig. 3—Regulator Mechanism.

mechanically disconnected from the rotor, the connection therewith being controlled by a voltage relay, the winding of which is energized from the regulated side of the feeder. Referring to Fig. 3, it will be seen that the motor through a worm gear, a bell crank and a rod *a* causes an arm *b*, known as the rocker arm, to oscillate over a ratchet wheel *c*, which is mechanically connected with the rotor by means of a worm and a gear. The rocker arms contain two pawls *d*, which normally are held locked by the triggers *e* in such positions that they do not engage with the ratchet wheel, but are released when the triggers strike the trip pins *f* of the voltage-relay arm. Depending upon which pawl is released, the ratchet wheel is rotated one way or the other, thus causing the feeder voltage to be raised or lowered.

The voltage relay consists of a solenoid having a floating core, the upper end of which is connected to a pivoted arm and which contains the trip pins *f*. A helical spring is connected to the other end of the lever and is used for adjustment. Normally the relay arm is held horizontal, but if the feeder voltage drops below or increases above normal, the left side or the right side of the arm descends, the trip pins thereby causing the left or the right pawl of the rocker arm to be released, thus causing the regulator to be rotated one way or the other. A finger *h* is provided for the purpose of raising the released pawl just before it reaches the limit of its travel, thereby causing it to be again locked by its trigger, so that if the voltage has reached its normal value, no further movement of the ratchet wheel will take place, while if the voltage is still off normal the trigger will again release the pawl and the operation continue until the voltage is brought back to normal.

A device for limiting the movement of the rotor is provided and consists of two cams mounted on a common arm, which can turn on the shaft of the ratchet wheel. When the limit of travel is reached the cam corresponding to the pawl which is acting is, by means of a lever arrangement, moved up underneath the pawl, thereby preventing it from engaging with the ratchet wheel. The other pawl, however, is free to operate the ratchet wheel in the opposite direction.

All parts of the regulator are contained in a dustproof and rainproof tank. The core and coils are located in the lower part of the tank and immersed in oil. A door is provided in the upper part of the tank which allows access to the mechanism for adjustment and oiling. After being once adjusted and carefully oiled, the regulator will run a long time without attention.

Fig. 2 shows the regulator installed on a pole as it appears in service.

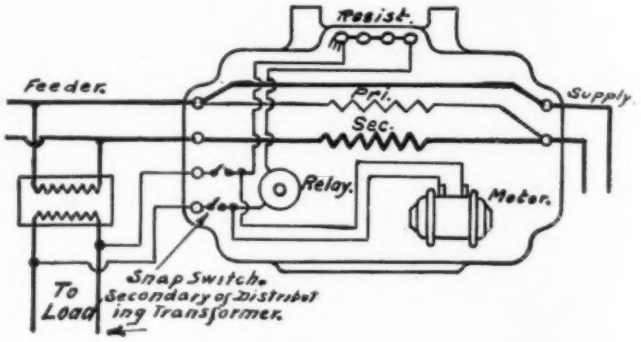


Fig. 4—Diagram of Connections.

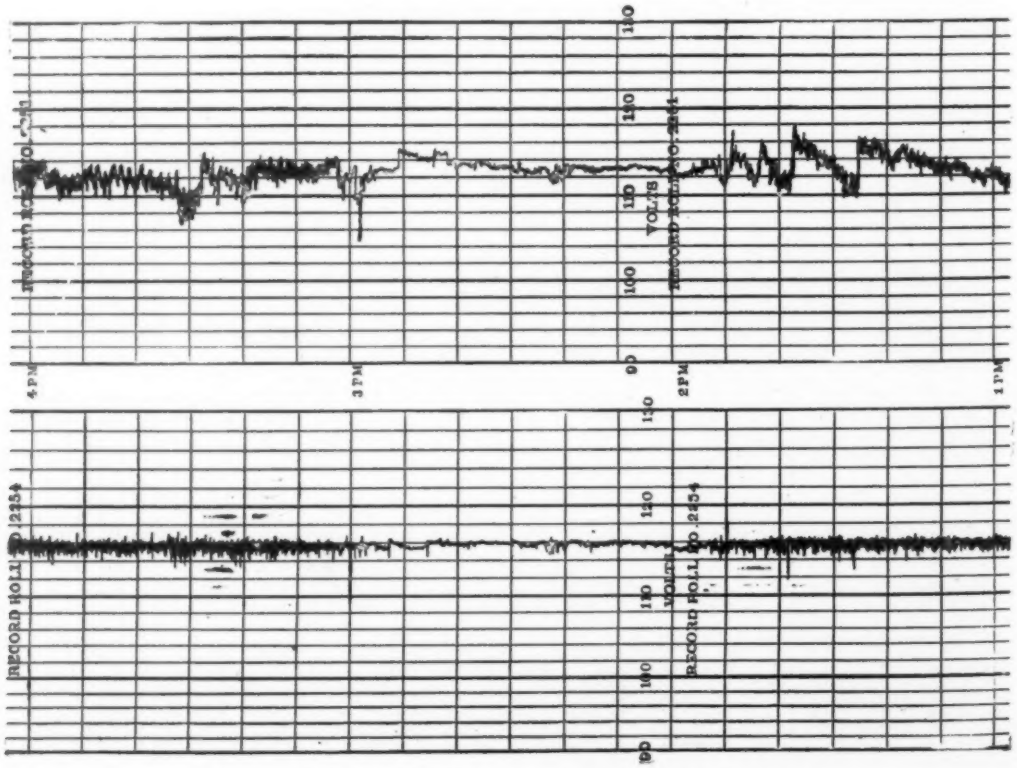


Fig. 5—Voltage on Generator and on Feeder Side of Regulator.

McWilliams Simplicity Metering Panelboard.

No electrician who has looked inside meter closets of the average type found in large office buildings need be told that these closets are rather generally about as complete models of confusion as one could ask to be shown. Loose, dangling wires and a construction which is in general of a kind that makes it very difficult to trace out any circuit or to add circuits on the load side of a meter has until recently been very common practice. And this faulty construction has not been confined to office buildings, nor even to what would generally be classed as large buildings; one sometimes sees even comparatively small apartment houses in which the arrangement of the tenants' meters is badly lacking in neatness and simplicity.

With a view to eliminating as far as possible the conditions just mentioned the George Cutter Company, of South Bend, Ind., developed and is now selling what is known as the McWilliams Simplicity Metering Panelboard, the construction and use of which is illustrated in the accompanying cuts. This board fulfills its purpose admirably. The general plan of the board is illustrated in Fig. 1. It will be noted that the connection is made to the feeders which deliver power at the distributing center at the bottom of the panel. The neutral of the three-wire service is carried up on either side of a group of parallel meter bars, 12 of which are shown in the figure.

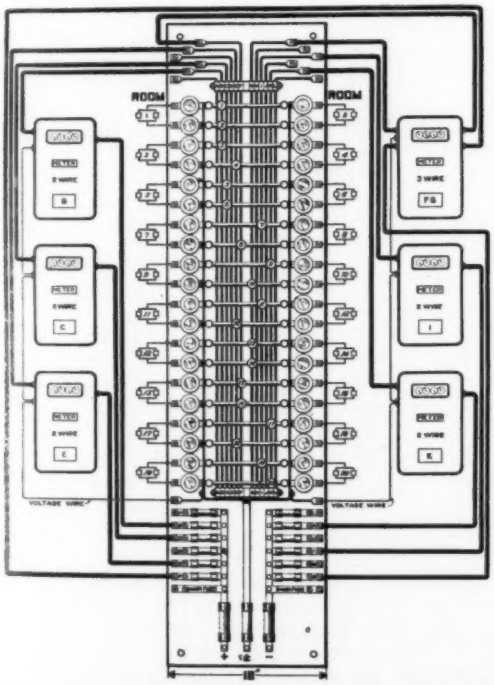


Fig. 1.—Typical Arrangement of McWilliams Metering Panelboard.

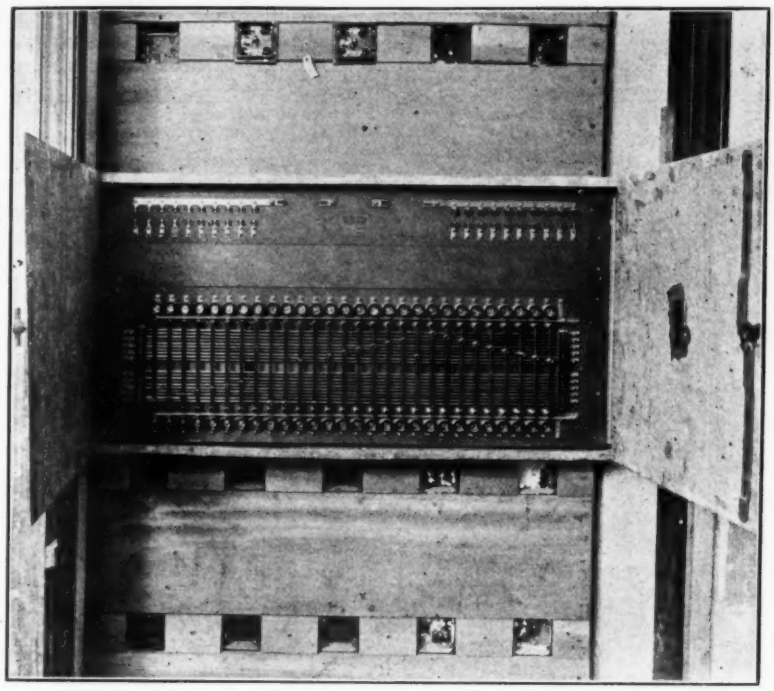


Fig. 2.—McWilliams Metering Panelboard Before Meters Were Installed.

These bars are all in one plane and are crossed with consumption circuit bars from opposite sides of the panelboard, which bars are clamped to the parallel meter bars by means of sliding contactors which can be readily moved into any desired position on the consumption circuit bar and clamped there securely. In other words, any one of the 20 circuit bars shown can be clamped to any one of the 12 meter bars. The path of the current is from one of the outside wires, say, through the meter fuse, then through the meter to one of the meter bars, and finally through the load on the branch circuit and back to the neutral conductor. The reader will note that in the diagram Rooms 1, 2 and 3 are all connected on Meter B, shown at the upper left-hand corner of the figure, and that other rooms could be put on the same meter by simply moving the sliding contactors into the proper position. It is also apparent from Fig. 1 that the fuse capacity on the line side of the meter can be increased at will. Thus additional circuits can be connected on any meter without confusion or danger of improper connections. No reference to a wiring diagram is necessary in adding these circuits, for all busbars and wire terminals are arranged to show every connection clearly.

Fig. 2 is a photograph of a part of a meter closet containing a McWilliams Simplicity Metering Board, no meters having been installed when the photograph was taken. The meter bars are horizontal in this panel and the main-line and meter fuses are arranged above the panel boards. There is no neutral fuse, this being an installation in Chicago, where local rules prohibit the fusing of the neutral. The meters will be installed on the boards above and below the metering panel and connections will be made to them through Cutter Meter Loop terminals set in the outlet boxes under the openings cut in the boards.

A large number of the McWilliams Simplicity Metering Panelboards have lately been installed in Chicago buildings, and the George Cutter Company is now building boards of this type for two very large office buildings.

New Pelouze Flatiron.

A new form of electric flatiron has been placed on the market by the Pelouze Manufacturing Company, 232 East Ohio Street, Chicago. As shown in the accompanying cut, its distinctive feature is the support of the handle at the rear end only, thus leaving the front of the iron free and unobstructed for entry into sleeves, pockets, arm holes, etc., that cannot be reached by the ordinary iron.

This new iron, known as the Pelouze Progressive iron, is of rugged construction and highly finished in nickel. The nose of the iron is smoothly rounded so that laces and other delicate fabrics cannot get caught. The iron takes 500 watts and heats quickly. It is furnished with a patented quick-break switch plug, which is easily removed by

Pelouze Progressive Iron.

a pull on the knob of the tension spring. It requires no stand because it needs simply to be tipped back on the heel. The standard weight of this iron for general family use is 6.5 pounds. Its cost is low.

New Pass & Seymour Receptacles.

To the already very extensive line of sockets and receptacles manufactured by Pass & Seymour, Incorporated, Solvay, N. Y., has recently been added a considerable number of new receptacles. Of these Fig. 1 shows a pull receptacle especially designed for mounting on four-inch ceiling outlet boxes. In the past it has been the practice to use in such cases a pull receptacle which was primarily designed for use as a wall receptacle. The new device was, therefore, developed to fill this need. The porcelain projecting ring of this new receptacle insulates the metallic shell from the outlet box and also from the ceiling as a whole,

Fig. 1.

thus permitting the use of this device on metal ceilings which are so frequently used in stores. This receptacle, which is known as No. 428, is regularly supplied with a chain 18 inches long, but on special order can be provided with a pull chain of any length or with a silk cord in place of the chain. This receptacle is particularly serviceable in barber shops and stores of all kinds in which it is desired to have a convenient means of controlling a pendent lamp without stepping to a more or less distant wall to reach a regular wall switch. It provides, moreover, a more rugged construction than when a pull socket is used at the lamp.

In Figs. 2 to 4 are shown three new key, keyless and pull-type receptacles designed particularly for use with condulet bases; these are known as Nos. 461, 462 and 463, respectively. In Figs. 5 to 7 are shown similar receptacles designed for use with wood molding or Paiste pipe taplets; these bear the

Fig. 2.

Fig. 5.

Fig. 8.

Fig. 3.

Fig. 6.

Fig. 9.

Fig. 4.

Fig. 7.

Fig. 10.

designations Nos. 458 to 460, respectively. Figs. 8 to 10 show Nos. 452, 453 and 454 key, keyless and pull receptacles for use in open-wiring systems. All of these nine receptacles just referred to are equipped with the Fluto style interchangeable shell, which is interchangeable with the entire line of Pass & Seymour Fluto sockets and receptacles. These receptacles serve to make this line of devices still more complete than it already was.

Native merchants in the large cities of China are taking up the use of electrical appliances, particularly electric lighting which is rapidly increasing in popularity. The use of electric fans is also increasing.

French Interests Seek Manufacturing Rights from American Electrical Companies.

The Banque Mutuelle d'Etudes, 8 Rue Nouville, Paris, France, is seeking on behalf of one of its French companies the representation in France, and, if possible, Belgium, Switzerland and Spain, of American houses making electrical lighting apparatus. The company will also handle electrical goods. The company in question, it is stated, has a capitalization of 250,000 francs, and it has been decided to increase its capitalization to 750,000 francs. The company has a well developed business organization, numerous traveling men, and representatives in Lyons, Nancy, St. Etienne, Lille, and is at present studying the advisability of establishing depots in the large French cities The company states that it has a factory and is going to install a second one in Lyons, and will undertake the manufacture and exclusive handling in France and in the countries above indicated of apparatus protected by patents relating to electric lighting or electric apparatus in general.

The supply of electric power over extensive agricultural and industrial areas in Germany has increased to such an extent that flour millers are complaining because the electric power enables many farmers to start small mills of their own.

Current Electrical News

LIGHTING AND POWER.

(Special Correspondence.)

SAC CITY, IOWA.—A municipal electric light plant will be established in this city. C.

ALTON, IOWA.—A movement is on foot to install electroliers on Main Street. C.

BAKER CITY, ORE.—Plans and specifications are being prepared for a municipal lighting plant.

EARLY, IOWA.—Citizens have voted to establish a municipal electric light plant in this place. Z.

VALLEY JUNCTION, IOWA.—Citizens have voted in favor of a municipal electric lighting system. C.

MANSON, IOWA.—D. M. Stearns, of Humboldt, Iowa, plans to connect Manson with an electric transmission line. C.

WEBSTER, S. D.—The City Council has decided to make extensive improvements in the local electric light system. C.

BOWBELLS, N. D.—J. W. Bearden, an electric light man, is planning the installation of an electric light plant here. C.

KEOKUK, IOWA.—The Keokuk Electric Light Company will soon install the new "White Way" system in that city. C.

BARBERTON, O.—The Council will issue $110,000 electric bonds. Address G. M. Kerns, president of the Council, for information.

ARGENTINE, KANS.—$200,000 will be expended extending the municipal electric light plant in Argentine. Address the city clerk.

MARSHALLVILLE, GA.—$5,000 will be expended for an electric light plant here. Address the mayor for information relative thereto.

BREAUX BRIDGE, LA.—The town is planning to construct an electric light plant here. Address the town clerk for particulars.

CLEVELAND, OKLA.—This city is planning to establish an electric light plant. Address the city clerk for information in regard to the matter.

POMEROY, IOWA.—The Council plans to secure electric lighting from a transmission line 14 miles in length. Address the city clerk for particulars.

CHEROKEE, IOWA.—Funds are being solicited for the installation and purchase of electroliers to be used on the main street. C.

MAYVILLE, N. D.—All bids for the erection of a complete electric light plant have been rejected and new bids are called for July 15. C. A. Vangen. C.

BLOOMINGTON, ILL.—A movement has begun for the installation of ornamental lights on Monroe, Madison and Jefferson Streets. Ed Sellman is interested. Z.

POLK, NEB.—Bonds to the amount of $16,000 have been voted for establishing an up-to-date electric light plant here. Address the city clerk for particulars.

FORT GAINES, GA.—Interested citizens of this city and Montezuma are planning to establish an electric light plant here at a cost of $10,500. Address the city clerk.

PERRYVILLE, KY.—The Perryville Ice & Lighting Company plans to double the capacity of its electrical plant, and to furnish 24-hour service. W. J. De Baun is general manager. G.

ATLANTA, GA.—The Council has passed an ordinance which reserves to the city the right to demand the New York Destructor Company to install a $100,000 generating plant.

PATERSON, N. J.—It is reported that the Society of Useful Manufacturers will erect a new hydroelectric power house for the development of turpentine at the Passaic Falls.

HIGHLANDS, N. J.—Sealed proposals will be received at the office of Tunis H. Lane, clerk of the borough until June 30 for lighting the streets, in accordance with specifications.

BREWTON, ALA.—The Downing Industrial School is planning to install a private electric lighting plant here at a cost of $55,000. W. W. Downing is chairman of the Building Committee.

QUINCY, ILL.—It is proposed to form a company here to sell power secured from the Mississippi River Power Company, at Keokuk, to a number of towns near Quincy. John N. Schoneman is interested. Z.

CALGARY, ALTA.—Tenders are to be called for an addition to the power plant, consisting of gas-fired boilers and turbogenerators, to cost about $6,000. For information address J. M. Miller, clerk, City Council. C.

IOWA CITY, IOWA.—The Iowa City Light & Power Company is to build a new trunk line from Coralville, the village across the Iowa River, where its electric light plant is located, to Iowa City.

VICTORIA, B. C.—Tenders are to be called for lighting supplies, including lamps and apparatus for Ross Bay, Marine Drive, together with poles and cables for other parts of system. W. J. Dowler, city clerk, should be addressed. C.

SPARTANBURG, S. C.—The Southern Power Company is planning to erect a transformer station near Saxon Mills for the purpose of supplying power to operate the cars on the suburban lines between Spartanburg and Greenville.

TULSA, OKLA.—The Ox-Bow Bend Power Company has been incorporated with a capital stock of $100,000 to construct a hydroelectric plant on the Arkansas River, about 60 miles from Tulsa, to develop 42,000 horsepower.

RICHMOND, CAL.—The Great Western Power Company has been granted a franchise in Contra Costa county, and it is reported will begin immediately to extend its lines to Richmond, Rust, San Pablo, Pinole and Loden. Over 150 miles of new lines are promised.

BREMERTON, WASH.—The City of Bremerton is to have a municipally owned electric light plant, having purchased the plant of the Bremerton-Charleston Light & Fuel Company. It is understood some improvements are planned. O.

COLUMBIA, MO.—Seniors in the electrical engineering department of the University of Missouri are busy drawing plans for a 1,600-horsepower plant which will be installed at the University. F. H. Saeger, of St. Louis, has been chosen as business manager of the enterprise.

SAN FRANCISCO, CAL.—The San Diego Consolidated Gas & Electric Company has petitioned to the State Railroad Commission for authority to issue $639,000 of bonds, of the proceeds $459,000 is to be used to make necessary extensions to the company's plant.

PIGGOTT, ARK.—The Piggott Power Company, which proposes to construct and operate a waterworks and an electric lighting system in Piggott, has filed articles of incorporation, capitalized at $25,000. The incorporators are G. W. Sietz, T. L. Davis, C. W. Pollard and others.

SPRING VALLEY, ILL.—The Spring Valley Utilities Company has been incorporated with a capital stock of $1,000,000, to manufacture and deal in electric current for all purposes. The incorporators are Charles H. Brown, Roy W. Brown, Constant Brown and Harry E. Brown. Z.

RICHMOND, VA.—A state charter has been granted to the Imperial Power Corporation, whose incorporators are C. W. Wetmore, G. W. Phillips, Jr., V. W. Cuttin, of New York City; Thomas B. Gay, H. H. Chalkney and Ernest Flippen. The capital stock of the company is given as $15,000,000.

NORFOLK, VA.—The Norfolk & Western Railroad Company is reported as intending to electrify its lines and is asking for bids for its own generating station, which will be of 24,000 horsepower capacity. Coal will be used as fuel as the plant will be located right in the heart of the Pocohontas coal region.

BALTIMORE, MD.—The Consolidated Gas Electric Light & Power Company was authorized by the Public Service Commission to issue over $800,000 four-and-one-half-per-cent bonds. The proceeds will be used in acquiring property and in extending and developing the company's gas and electric plants.

DUNDEE, MICH.—The Dundee Light plant has been purchased by N.

D. Carpenter, of Detroit. Mr. Carpenter proposes to improve and operate the plant which now has a capacity of about 300 horsepower and supplies electric current for public and private lighting and for power purposes in Dundee.

ABERDEEN, WASH.—A petition signed by many prominent business men has been presented to the City Council asking that a municipal lighting and power plant, to be located at the headquarters of the Wyanooche River, be constructed. The proposed improvement will cost at least $300,000. O.

ELLENSBURG, WASH.—The City Council is planning the purchase of additional arc lights for the city streets, same to be placed on every corner in the paved section of the city. A petition to put cluster lights from Ruby to Sampson Streets, on Third Street, will be presented to the Council shortly. O.

GOLDENDALE, WASH.—The City Council is receiving bids for the improvement of its water system. The capacity of the distribution system will be tripled, and a 600,000 gallon reinforced concrete reservoir will be built. Bonds in the sum of $26,000 for this improvement were recently voted at a special election. O.

BUTTE, MONT.—A petition asking the City Council to extend the arc lighting system to practically the whole of the business district will be presented to that body shortly. Over one-half of the property owners in the district named have signed the petition and it is understood that the Council unanimously favors the plan. O.

COLUMBUS, O.—The Board of Administration has decided to erect a power plant at the state hospital and also one at the Girls' Industrial Home, near Delaware. It is the purpose of the Board to erect these plants so that sufficient power can be generated to do all the necessary power work about the respective institutions.

KLAMATH FALLS, ORE.—City Attorney J. C. Rutnic has written to the Department of the Interior to inquire as to what arrangements could be made whereby the Government would furnish Klamath Falls with electricity for light and power. All power sites along Link River lie in the hands of private companies of the United States.

KALAMAZOO, MICH.—It will soon be up to the lighting commission to decide upon the style of decorative lights to be used in the city for which the citizens voted a bond issue of $150,000. The work on the power plant has been started and will be pushed to rapid conclusion and the question of the style of lights to be installed is now being considered.

MONTESANO, WASH.—F. L. Harung, of the Hoquiam Sash & Door Company, and F. Norton Babo are the organizers of a light and water company, which will apply to the City Council for a franchise at once. This company recently purchased the Syverson Mill and appurtenances, and asserts that current for light and power can be furnished within a month. O.

BAY CITY, ORE.—The Bay City Land Company, here, has been granted a franchise by the City Council to operate an electric light and power plant in this city. Under the terms of the franchise the City reserves the right to purchase the plant in 1920, or at the end of any three-year period thereafter. The present service will be extended at once to meet all requirements. O.

VISALIA, CAL.—It is reported that the Mount Whitney Power & Electric Company is preparing plans for the Tuolumne Light & Power Company project. A survey was made in 1908 for an immense power project to generate power from the north, middle and south forks of theTuolumne River in Tuolumne County and it is proposed to start work this summer. The project will cost close to $2,000,000.

NEW ROCKFORD, N. D.—Because of differences between the Western Utilities company and certain residents of this city, a municipal electric light plant and waterworks system may be established. Some months ago a franchise was granted the Western Utilities Company for a light and a water plant but it was found the company was not making the necessary arrangements. The promoters of municipal ownership became active and there will be a bond issue voted upon.

SANTA FE, N. M.—It is reported that a syndicate of Chicago men has taken over the projected White Rock canyon hydroelectric project, which was being promoted by Charles M. Lang, of Salt Lake City, and associates. It is planned to build a dam across the White Rock canyon and construct a large hydroelectric plant. A system of power transmission lines will also be built, running to Albuquerque, Santa Fe, Las Vegas and a number of other towns and cities. D.

PORT MOODY, B. C.—This city is contemplating the installation of an elaborate street lighting system to furnish illumination in the neighborhood of the two main streets as well as adjoining thoroughfares. Applications are now being received from the Western Canada Power Company and the British Columbia Electric Company with a view to obtaining prices for an early installation. The Council is also considering the proposition of providing a lighting system for the South Shore District. O.

BURT, IOWA.—The Burt Light and Power Company has completed its organization with a paid-up capital of $6,000. It is proposed to install a complete electric plant for Burt, equipped for 24-hour service. The company is undecided as to what kind of prime mover will be employed, but is considering the merits of the gas producer, oil and steam. W. H. Grover, of Ames, Iowa, has been employed to prepare complete plans and specifications for the outfit. The electric equipment will be direct-current, 220 and 110 volts, with a storage battery. The officers are L. M. Owen, president, and C. B. Chipman, secretary.

TUCSON, ARIZ.—The Federal Light & Power Company, of New York, holding company for the Tucson Gas, Electric Light & Power Company, and the Tucson Rapid Transit Company, is making a tentative offer to spend between $125,000 and $150,000 in extensions and improvements of the street railway and street lighting systems in Tucson; provided the City Council will grant a new contract to the company for lighting at a rate no higher than at present. The plan of improvements was conceived by W. A. Halley, general superintendent and chief engineer for the Federal Light & Traction Company.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

CARTHAGE, S. D.—Farmers have organized a co-operative telephone company. C.

JAMESTOWN, N. D.—The rural telephone controlled by farmers will be extended. C.

NEW ENGLAND, N. D.—A franchise was granted to the Rainy Butte Telephone Company. C.

CLINTONVILLE, WIS.—The Marion & Northern Telephone Company is planning for improvements to the exchange.

VANCOUVER, WASH.—The Southwestern Washington Telephone Company has been granted a franchise in this city.

SPRINGDALE, WASH.—The Camas Valley Telephone Company will reconstruct its telephone lines in this vicinity at once. O.

WHITTIER, CAL.—It is reported that the Whittier Home Telephone Company will extend into the Happy Valley district, and also into North Whittier Heights.

SIOUX FALLS, S. D.—The New Era Farmers' Telephone Company has been incorporated by Olaf Larson, Michael Jones and others. The capital stock is $5,000. C.

SENATOBA, MISS.—The Cumberland Telephone Company will improve and overhaul its plant. New phones will be put in and a local manager installed. Address C. G. Simmons for further particulars.

CHEHALIS, WASH.—The County Commissioners of Lewis County recently granted a franchise to the Pleasant View Telephone Company for the construction of telephone lines along certain roads of this county. O.

CLOVERDALE, CAL.—The Cloverdale Light & Power Company has been granted permission to sell its plant to the California Telephone & Light Company for $75,000, on condition that the purchasing company expends $25,000 on new construction within five years. The application for authority to issue $75,000 in common stock was withdrawn and permission was granted to issue bonds in the sum of $75,000 and $50,000 of preferred stock.

COSMOPOLIS, WASH.—The Elk Creek & Grays Harbor Railway Company recently filed articles of incorporation with the Lewis County Auditor. The capital stock is given at $50,000, the life of the corporation being placed at 50 years. The trustees of the company are R. W. Mersereau and E. L. Mersereau, both of Doty, Wash., and W. B. Mersereau, of Portland, Ore. The company purposes constructing a logging road and telecconstructing and telegraph and telephone lines from Doty to Cosmopolis. O.

GOLDENDALE, WASH.—A consolidation of the telephone systems of the Home Telephone Company, of Hood River; the White Salmon Valley Telephone Company, of White Salmon, and the Goldendale Telegraph & Telephone Company, of Goldendale, has been effected by the transfer of all the property including franchises, leases, and contracts to the Oregon-Washington Telephone Company, an Oregon Corporation recently organized at Hood River. It is reported that much construction work will be carried on. O.

ELECTRIC RAILWAYS.

(Special Correspondence.)

EARLY, IOWA.—The Council will establish a telephone system. Address the city clerk.

SAN FRANCISCO, CAL.—The Salt Lake & Utah Railroad Company has been organized to build an electric line from Salt Lake to Payson.

DES MOINES, IOWA.—The Des Moines City Railway Company has been granted permission to extend its tracks south and east of Fort Des Moines. C.

PORTLAND, ORE.—The Errol Heights Railway Company has been granted a franchise to construct and operate an electric railway on certain streets in Portland.

MORRISTOWN, N. J.—The Morris Railroad Company has increased its capital stock to provide for the construction of its proposed electric line between Morristown and Madison.

BRADFORD, ILL.—The Central Illinois Interurban Railway Company has started surveys on its proposed electric railway to connect Kewanee, Osceola, Bradford and Henry. John R. Fate is in charge of the project.

SPRINGFIELD, MASS. — The Springfield Street Railway Company has been granted a franchise for the construction of an electric railway on certain streets in Springfield. E. J. Dickson, of Springfield, is manager.

TOLEDO, ILL.—The Cumberland County Board of supervisors has granted a 50-year franchise to the Decatur, Sullivan & Mattoon Transit Company to build and operate an interurban railway through Union Township. The road will run from Mattoon to Casey.

CINCINNATI, O.—The Cincinnati, Newport & Covington Railway & Light Company is to purchase a new franchise to be offered in Newport, Ky., to be known as the East End line. It will involve new construction of several miles.

FRANKLIN, TENN. — The Middle Tennessee Traction Company has increased its capital stock from $10,000 to $250,000. The company proposes to build an interurban line from Franklin to Shelbyville, a distance of 45 miles.

TIPTON, IOWA.—Tipton and Davenport are soon to be connected by an interurban railroad which will later be continued to Cedar Rapids, if plans placed before the Commercial Club by John A. Reed, of the Iowa Railway & Light Company of Cedar Rapids, are consummated.

CHICO, CAL.—Another branch will soon be added to its network of lines in the Sacramento Valley by the Northern Electric Company of this place. Rights of way have been secured from Meridian, Sutter County, to Woodland, Yolo County. The length of this line will be about 50 miles and will open a vast territory of rich forming land.

LOUISVILLE, KY. — The Kentucky Southwestern Electric Railway, Light & Power Company has authorized the sale of $2,000,000 of bonds, which have been underwriten at 80, and will build the first division if its proposed interurban traction line at a cost of $1,300,000. Fred Smith has been appointed general manager of the company. G.

BENTON, ILL.—It is reported that George C. Ferguson, F. S. Tainter, of New York City; and D. F. Darnell, of Decatur, Ill., are favorably impressed with a project to build an electric interurban from Venton to Christopher, south to Herrin and Johnson City, all mining towns. It is estimated that it will cost $25,000 a mile to build.

JEFFERSON CITY, MO.—A new franchise for 25 years has been granted by the City Council to the Jefferson City Bridge & Transit Company for its street railway system. The company asked for the new franchise to make extensive improvements in the roadbed and rolling stock. Considerable double tracking will be done, new cars put in service and a mile or more of extension made.

HOUSTON, TEX.—The Houston & Brazos Valley Terminal Company has been granted a 50-year franchise to operate in several towns adjacent to Freeport, which will be the principal place of business. The capital stock of the company is $300,000 and the directors are Felix Jackson, James A. Baker and C. N. Schaff, of Houston; E. R. Cobb, of Freeport, and W. A. Webb, of Dallas.

SANTA BARBARA, CAL.—R. H. Gaud, of this city, is now prepared to bid for a franchise for the Mission Ridge extension of the present Santa Barbara electric system. The deeds for the right of way have been secured and just as soon as the franchise has been granted work on the roadway for this and also the State Normal school line, will be started. This will be a signal for the building of the electric line to the Rivera district.

BILOXI, MISS. — A traction line from Mobile to Biloxi was discussed in detail at the meeting which organized the New Orleans, Mobile and Mississippi Coast Federation of Commercial Bodies here. The line would connect with the electric line extending from Biloxi to Pass Christian. A special committee composed of W. H. Bouslog, J. J. Mc Intosh, Dr. A. Babengrier, G. W. Grayson, E. C. Fowlkes and E. B. Dunton was named to further the project.

EUREKA, CAL.—At a convention held here June 12, it was decided by the delegates from Humbolt and Siskiyou Counties, Cal., and Klamath County, Ore., to incorporate the Humbolt, Siskiyou & Klamath Railway Company, to build and operate an electric line between Eureka and Klamath Falls, a distance of 350 miles. A committee of nine was appointed to file articles of incorporation and to raise $35,000 at once for initial expenses. L. F. Putter, of Eureka, was chairman of the convention.

ROANOKE, VA.—The Norfolk & Western Railroad Company has authorized and is proceeding with the electrification of its main line from Bluefield, W. Va., to Vivian, W. Va. The work is being handled by Gibbs & Hill, consulting engineers in New York. It is to be completed and the equipment ready for service during the summer of 1914. It is understood that overhead electric conductor will be used, the local conditions precluding the use of the third rail. The electric service will be confined for the present to traffic designated as "tonnage" trains. Plans and estimates are being made for the use of either alternating-current or direct-current locomotives according to the design which proves most adaptable to the service. A power house will be erected at Bluestone, which is on the line of the railway about one-third of the way from Bluefield to Vivian. The graph and telephone lines from Doty to Cosmopolis. O.

NEW INCORPORATIONS.

VERMONT, ILL.—The Vermont Telephone & Exchange Company has been incorporated with a capital stock of $1,000. O. H. Russel is president.

SEATTLE, WASH.—North Coast Electric Company has been incorporated with a capital stock of $60,000 by Harry Byrne, W. R. C. Coche and others, of Seattle.

SAN FRANCISCO, CAL.—The Gas & Electric Appliance Company has been incorporated with a capital stock of $100,000, by S. P. Hamilton W. T. Morris, and W. F. Boardman.

EVANSTON, ILL.—The Electric Commercial Company has been incorporated with a capital stock of $6,000 to deal generally in electrical apparatus. The incorporators are Morris K. Levinson, E. Roesing and A. S. Dwyer.

NEW PUBLICATIONS.

RESUSCITATION.—Charles A. Lauffer, M. D., medical director of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has prepared a booklet entitled "Resuscitation." This book includes a reprint of a paper on this subject delivered by the author before the Philadelphia Section of the National Electric Light Association. The author, after explaining a number of successful results which have been obtained from employing resuscitation methods on men who were supposedly dead, gives a clear description of the mechanism of respiration, illustrating same by a number of views of the various parts of the anatomy. The prone pressure or Schafer method of resuscitation which has been adopted by the National Electric Light Association, and a number of other engineering societies, is described in detail. This book brings out in a clear, concise manner the necessity of people in general being versed in the principles of resuscitation, and clearly shows how they can be learned so as to prove of valuable assistance to persons in the ordinary walks of life.

PROPOSALS.

ELECTROLIERS.—Bids will be received by E. J. Bestick, city clerk, Detroit, Mich., until July 7 for the installation of electroliers. Check for ten per cent must accompany all bids, and the city reserves the right to reject any or all bids.

SWITCHBOARD, ETC.—Bids will be received by Guy F. Burnap, 311 Locust Street, Findlay, O., until July 10 for gas engine, generator, switchboard and other supplies to be installed at Vanlue, O. Further information will be furnished upon application to the above address.

ELECTRIC DUMB-WAITER.—Sealed proposals will be received at the office of the Supervising Architect, Washington, D. C., until July 11 for an electric dumb-waiter in the United States Marine Hospital, New York, N. Y., in accordance with specifications, copies of which may be obtained from the Supervising Architect.

ELECTRIC LAMPS AND MOTOR BOATS.—Sealed proposals will be received at the office of the General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., until July 9 for furnishing electric lamps and motor boats, as per circular No. 781, copies of which may be obtained from the assistant purchasing officers located in any of the large cities.

FINANCIAL NOTES.

Stockholders of the Philadelphia Company for Guaranteeing Mortgages voted to increase the capital of the company from $1,000,000 to $2,000,000.

John P. O'Brien & Company, of Boston, were the successful bidders on June 10 for $10,000 5.5-per-cent ten-and-a-half-year average municipal-electric-light-plant bonds of Dysart, Tama County, Iowa.

The Cities Service Company is offering through Henry L. Doherty & Company and a syndicate of brokers $2,000,000 of its five-year, seven-per-cent convertible coupon notes at par and accrued interest.

The Great Northern Power Company has filed an amendment to its articles of incorporation with the secretary of State at St. Paul, increasing its capital stock from $2,250,000 to $11,000,000.

The Ohio Electric Railway Company has given a second and general mortgage to the Fidelity Trust Company, of Philadelphia as trustee to secure an issue of $5,000,000 of bonds.

The transfer of the properties of the Tulsa Corporation to the Public Service Company of Oklahoma, recently incorporated in this State, with a capital of $3,000,000, has been completed.

Arrangements to extend the $1,000,000 Compton Heights Union Depot and Terminal bonds of the United Railways for ten years have been made and $750,000 bonds of the Baden & St. Louis Railway Company and the Taylor Avenue Railway Company will be redeemed on maturity—July 1.

The Lehigh Valley Transit Company at a special meeting of stockholders authorized an increase of $1,000,000 in the bonded debt of the company for the purpose of acquiring control of the Easton Consolidated Electric Company.

The Middle West Utilities Company has sold to a syndicate of Chicago bankers $2,000,000 three-year six-per-cent collateral trust notes of an authorized issue of $3,500,000.

The capital stock of the Ohio Electric Company has been reduced from $25,000,000 to $14,000,000. Of the common stock $8,000,000 has been issued and also $8,000,000 preferred stock. Of this stock, most of which has been held in the treasury, $2,000,000 will be retired.

The Oklahoma Public Service Corporation has been organized by the Insull interests to take over the electric light, power and gas properties at Guthrie, Okla., and six other Oklahoma towns, which were acquired in the last year by Insull and his associates. Negotiations are under way for the acquisition of the lighting and power properties at Lawton and other Oklahoma towns. The Oklahoma Public Service Corporation will be a subsidiary company of the Middle West Utilities Company, which also owns properties in Illinois, Indiana, Kentucky, New York, Maine and New Hampshire. Plans of the new company include the construction of a street railway in Lawton and the building of an interurban line between Lawton and Fort Sill. Capitalization of the new corporation is $3,000,000.

At a meeting of the holders of the five-per-cent, fifty-year first mortgage debentures of the Bahia Tramways, Light & Power Company, held in London, the proposition of the board of directors to sell the entire property of the company, which includes the light and power company, to the municipality of Bahia for 17,000 contos paper, with other supplies on hand, was approved. The net result of this sale will be that the debenture holders will receive about $290 for each $500 debenture and the shareholders of the Bahia Tramways, Light & Power and the Compagnie l'Eclairage de Bahia will receive nothing. Owing to competition which, while declared illegal by the courts still continues, the company had a deficit, before providing for renewals, depreciation, and sinking funds for the debentures, of $205,000 in 1910, $130,000 in 1911 and 145,000 in 1912.

Dividends.

American Gas & Electric Company; a quarterly preferred devidend of 1.5 per cent, and a quarterly common dividend of two per cent; the former payable August 1, and the latter, July 1.

American Power & Light Company; a quarterly preferred dividend of 1.5 per cent, payable July 1 to stock of record June 20.

American Public Utilities Company, regular quarter of 1.5 per cent on preferred and 0.5 per cent on common, payable July 1 to stock of record June 20.

Augusta, Aiken Railway & Electric Corporation has declared a quarterly dividend of 1.5 per cent on the preferred stock, payable June 30, to stock of record June 20. Books close June 20, and reopen July 1.

Aurora, Elgin & Chicago Railway; a quarterly common dividend of $0.75 per share, payable July 10 to stock of record June 23.

Bell Telephone Company of Canada has declared the regular quarterly dividend of two per cent, payable July 1 to stock of record June 24.

Birmingham Railway, Light & Power Company; a semi-annual preferred dividend of three per cent, payable June 30 to stock of record June 25.

The Buffalo General Electric Company has declared the regular quarterly dividend of 1.5 per cent on the common stock, payable June 30 to stock of record June 20.

Capital Traction Company; a quarterly dividend of 1.5 per cent, payable July 1 to stock of record June 14.

Chicago City Connecting Railways; a preferred dividend of $2.25 per share, payable July 1 to stock of record June 16.

Cincinnati & Hamilton Traction Company; a quarterly preferred dividend of 1.25 per cent, and a common dividend of one per cent, both payable July 1.

Cities Service Company; the regular monthly dividends of 0.5 per cent on its preferred stock and five-twelfths of one per cent on its common stock, both payable July 1 to stock of record of June 15.

Cleveland Telephone Company; a quarterly dividend of $1.25 per share, payable June 30.

Colorado Light, Heat & Power Company; a quarterly preferred dividend of 1.5 per cent, and a common dividend of 1.25 per cent both payable July 1 to stock of record June 14.

Columbia Railway, Gas & Electric Company; the regular quarterly dividend of 1.5 per cent on the preferred stock, payable July 2.

Columbus Electric Company; semi-annual of $3, payable July 1 to stock of record June 23.

Connecticut River Power Company; semi-annual of one per cent on common.

Consolidated Traction Company of New Jersey; regular semi-annual of two per cent payable July 15 to stock of record June 30.

Continental Gas & Electric Company; the regular quarterly dividend of 1.5 per cent on its preferred stock, and an initial dividend of 0.5 per cent on its common stock, both payable July 1 to holders of record June 20.

Detroit Edison Company; regular quarterly of 1.75 per cent, payable July 15 to stock of record June 30.

Eastern Michigan Edison Company; regular quarterly of one per cent, payable July 15 to stock of record June 30.

Electric Storage Battery Company; regular quarterly dividend of one per cent on the common and preferred stocks, payable July 1 to stock of record June 21.

Halifax Electric Railway; quarterly of two per cent, payable July 2 to stock or record June 19.

Hudson River Traction Company; a semi-annual dividend of three per cent, payable July 1.

Illinois Traction System; a quarterly preferred dividend of 1.5 per cent, payable July 1.

Kansas Gas and Electric Company; quarterly of 1.75 per cent on preferred, payable July 1 to stock of record June 24.

Little Rock Railway & Electric Company; a common dividend of five per cent, and a preferred dividend of three per cent, both payable July 1.

Marconi Wireless Company of America; an initial dividend of two per cent, to be paid on August 1.

Massachusetts Lighting Company; regular quarterly dividend 1.75 per cent, payable July 15 to stock of record June 25.

Montreal Light, Heat & Power Company; a quarterly dividend of 2.5 per cent, increasing the annual rate from nine per cent to ten per cent.

CLOSING BID PRICES FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

	June 23	June 16
American Tel. & Tel. (New York)	127½	127⅛
Commonwealth Edison (Chicago)	128	127
Edison Electric Illuminating (Boston)	266	260
Electric Storage Battery common (Philadelphia)	46	47
Electric Storage Battery preferred (Philadelphia)	46	47
General Electric (New York)	134½	135⅞
Kings County Electric (New York)	129	129
Manhattan Transit (New York)	1⅜	1⅜
Massachusetts Electric common (Boston)	12	12½
Massachusetts Electric preferred (Boston)	67½	68
National Carbon common (Chicago)	113	111
National Carbon preferred (Chicago)	111	113½
New England Telephone (Boston)	137	135
Philadelphia Electric (Philadelphia)	21⅝	21⅜
Postal Telegraph and Cables common (New York)	76½	77
Postal Telegraph and Cables preferred (New York)	67	64½
Western Union (New York)	60¼	62
Westinghouse common (New York)	56¾	58
Westinghouse preferred (New York)	105⅞	106⅝

*Last price quoted.

National Carbon Company; regular quarterly of 1.5 per cent on common, payable July 15, and 1.75 per cent on preferred, payable August 15.

New England Telephone & Telegraph Company; the regular quarterly dividend of 1.75 per cent, payable June 30 to stock of record June 18.

Porto Rico Railways Company; quarterly of 1.75 per cent on preferred and one per cent on common, payable July 2 to stock of record June 21.

Public Service Corporation of New Jersey; regular quarterly of 1.5 per cent, payable June 30 to stock of record June 27.

Reading Traction Company; semi-annual of 1.5 per cent, payable July 1 to stock of record June 18.

Republican Railway & Light Company; the regular quarterly dividend of 1.5 per cent on its preferred stock, payable July 15, to stock of record July 1.

Shawinigan Water and Power Company; quarterly of 1.5 per cent, payable July 19 to stock of record July 7.

Trinidad Electric Company; regular quarterly of 1.25 per cent, payable July 10.

Utilities Improvement Company; the regular monthly dividends of 0.5 per cent on its preferred stock, and one-sixth of one per cent on its common stock, both payable July 1 to stock of record of June 15.

Washington Water Power Company; quarterly of two per cent, payable July 1 to stock of record June 14.

West End Railway Company; $3 on preferred, payable July 1 to stock of record June 21.

Westinghouse Electric & Manufacturing Company; the regular quarterly dividends of 1.75 per cent on the preferred, and one per cent on the common; common dividend is payable July 30 to stock of record June 30; preferred is payable July 15 to stock of record June 30.

Reports of Earnings.

BUFFALO GENERAL ELECTRIC.

The Buffalo General Electric Company reports for five months ended May 31, 1913, compared as follows:

	1913	1912
Gross	$636,563	$565,722
Net after taxes	275,513	233,778
Other income	10,563	14,522
Total income	286,076	248,300
Surplus after charges	216,105	180,987

LOUISVILLE RAILWAY.

The Louisville Railway Company reports for May and five months as follows:

	1913	1912
May gross	$338,816	$328,483
Net	139,757	140,534
Surplus after charges	66,591	73,534
Five months gross	1,517,604	1,459,836
Net	652,375	621,751
Surplus after charges	295,708	297,417

PACIFIC GAS AND ELECTRIC.

The Pacific Gas & Electric Company reports earnings for April and for the four months ended April 30, 1913, as follows:

	1913	1912
April gross	$1,325,733	$1,219,207
Net after taxes	592,441	543,734
Four mos. gross	5,485,324	5,052,021
Net after taxes	2,436,005	2,335,545
Sur. after chgs	1,174,600	.....

Surplus after charges for the first four months of the year is at an annual rate of about 6.5 per cent on the outstanding common stock, after sinking fund charges are provided for, while if sinking fund is not deducted from income the surplus after charges is equal to about nine per cent on the common stock for the year.

NEW YORK STATE RAILWAYS.

The report of the New York State Railways to the upstate New York Public Service Commission for the quarter ended March 31, 1913, compares as follows:

	1913	1912
Gross	$1,812,627	$1,728,107
Net after taxes	524,235	492,782
Other income	46,716	48,698
Total income	570,941	541,481
Surplus after charges	272,390	273,825

CONSOLIDATED CITIES LIGHT, POWER & TRACTION.

Consolidated Cities Light, Power & Traction Company reports earnings for May, 1913, and the five months ended May 31, 1913, as follows:

May gross	$ 47,775
Net after expenses	46,803
Surplus after charges	16,702
Balance after dividends	5,869
Five months gross	395,527
Net after expenses	389,259
Surplus after charges	240,444
Balance after dividends	186,278

PERSONAL MENTION.

MRS. L. P. SAWYER and MRS. ARTHUR GARRISON and daughter will sail on the steamship "Rotterdam," on July 1, to visit Great Britain and the Continent. They will be away about three months.

A. J. SWEET, of the engineering firm of Vaughn, Meyer & Sweet, Milwaukee, read a paper entitled "Notes on Postal Car Illumination" before the Chicago Section of the Illuminating Engineering Society on Friday, June 27. This was the last regular meeting of the section until October.

E. H. HAUGHTON, general manager of the Bryan-Marsh Electric Works, will sail on July 1 on the steamship "Hamburg" from New York to visit Gibraltar, Naples, and the Mediterranean, returning to this country about September 1. Mr. Haughton is accompanied by his father-in-law, JUDGE MALCOM YEAMAN, of Henderson, Ky.

W. W. BEACHFORD, of the Philadelphia office of the Federal Sign System (Electric) is making a three months' trip to Europe, visiting London, Paris, Berlin, Bolougne and other continental cities, in the interest of Federal products. The Federal porcelain enamel-steel section signs are gaining popularity abroad sufficient to justify the company sending a representative to foreign parts.

PAUL D. SEXTON has resigned as secretary of the Chicago Elevated Railways to become treasurer of McCoy & Company, of New York. Mr. Sexton was formerly secretary and treasurer of the Metropolitan Elevated Railway Company, with which he had been connected for the past 20 years. He has a wide acquaintance in corporation and banking circles in this country and Europe, where he has spent much of his time recently.

W. C. EARLE, chief engineer of the California State Railroad Commission, and J. T. SHAW, assistant rate expert, are investigating the matter of power line interference with telephone and telegraph lines at Los Angeles. The Commission is of the opinion that as a result of this investigation rules and regulations can be put into effect to reduce interference, and that its work will probably be of use in other parts of the world where high-tension power transmission lines are installed.

GEORGE WESTINGHOUSE has been voted the Grashoff memorial medal by the Society of German Engineers in session at Leipsig, Saxony, on June 23. Mr. Westinghouse was a member of the party of Americans, members of the American Society of Mechanical Engineers, who, with their families, are making a trip through the various German cities. King Edward August, of Saxony, was present on the occasion of the presentation of the medal to Mr. Westinghouse.

J. C. McPHERSON, who for a long time has occupied the position of division superintendent of the Pacific Electric Railway Company at Pasadena, Cal., has resigned that office to accept the position of general superintendent of the Oakland, Alameda & Berkeley line in Northern California. Prior to his departure for the north, Mr. McPherson was given a rousing farewell reception. About 150 of the employees of the Pacific Electric Company, of Los Angeles, accompanied by the officials of the company, went to Pasadena early in the evening, bringing with them the Pacific Electric band. They were met at the car barn by more than 150 Pasadena employees of the company and in a body the 325 men repaired to the McPherson home, and the home proved too small to hold them. The recipient was taken completely by surprise and was overcome by the expression of good will. Mr. McPherson was connected with the Pacific Electric Company for a number of years, and worked his way from the post of motorman to the position of responsibility he occupied when he resigned.

OBITUARY.

EBENEZER DEWING, former president of the Boston & Norfolk Street Railway Company, died at his home in Sharon, Pa., on June 17, at the age of 69.

WALTER F. TAYLOR, for many years superintendent for the Holtzer-Cabot Electric Company, Brookline, Mass., died on June 18 in Brookline at the age of 50 years.

DATES AHEAD.

Electrical Contractors' Association of the State of Missouri. Annual meeting, St. Louis, Mo., July 12.

Ohio Electric Light Association. Annual convention, Cedar Point, O., July 15-18.

National Electrical Contractors' Association. Annual meeting, Chattanooga, Tenn., July 16-19.

Michigan Section, National Electric Light Association. Annual convention, Ottawa Beach, Mich., August 18-21.

International Association of Municipal Electricians. Annual meeting, Watertown, N. Y., August 19-22.

Old-Time Telegraphe s and Historical Association and Society of the United States Military Telegraph Corps. Annual reunion, Detroit, Mich., August 26-28.

Association of Edison Illuminating Companies. Annual convention, Cooperstown, N. Y., September 8-11.

American Electrochemical Society. Annual meeting, Denver, Colo., September 9-11.

Northwest Electric Light and Power Association. Annual convention, Seattle, Wash., September 10-12.

Pennsylvania Section, National Electric Light Association. Annual convention, Delaware Water Gap, Pa., September 16-18.

Illuminating Engineering Society. Annual convention, Pittsburgh, Pa., September 22-26.

With the Electrical Manufacturers

Eastern Electric Lamp Company Division of the Franklin Electric Manufacturing Company, Hartford, Conn., has issued a card calling attention to attractive reductions in prices of Eastern Mazda lamps.

Heap & Digby, engineers, 48 Westminster Palace Gardens, London, England, have been appointed agents and engineers for the Underwriters' Laboratories, Incorporated, in Great Britain and Ireland.

Belden Manufacturing Company, Twenty-third Street and Western Avenue, Chicago, has issued its discount list No. 114, which gives the discounts on the prevailing base prices of all its numerous lines of bare and insulated wires.

General Electric Company, Schenectady, N. Y., has issued a handy little booklet on its G-E snap switches for 250-volt circuits. The switches illustrated are of many types, including the rotary-snap switches, push-button and locking wall switches, pendent switches, etc.

National Supply Company, 416 West Indiana Street, Chicago, has issued several bulletins, of which No. 100 deals with the Billow System of fuel-oil pumping units; bulletin No. 120 deals with fuel-oil atomizers with accessories; bulletin No. 110 is devoted to steel storage tanks and appurtenances therefor.

Manhattan Electrical Supply Company, New York, N, Y., has received an order for 5,000 of its No. 6341 receptacles and plates; these will be installed in the new municipal building in New York City. This is the largest order ever placed for an installation of this type of receptacles in a single building.

The Valentine-Clark Company, Minneapolis, Minn., has called the attention of the trade to a rather short general supply of cedar poles and that the production this year would probably be 50 per cent less than that of last year. Pole-using companies are, therefore, urged to place their orders early in order to have a good selection of the poles needed.

Simplex Wire & Cable Company, 201 Devonshire Street, Boston, Mass., has issued a new price list of Simcore wires and cables. This gives the cost in dollars per 1,000 feet of single and double-braid conductors for various copper-wire base prices. Tables of freight additions are also given and a table of carrying capacities of rubber-covered and weatherproof copper wires is included at the end of the book.

Chelton Electric Company, Philadelphia, Pa., has issued a new catalog of its electrical specialties. This is well illustrated throughout and contains descriptions of shallow push-button and lock wall switches, switch and receptacle plates, flush wall receptacles of several types, indicating heater and switch receptacles, steel and cast-iron switch boxes, etc. Views of large buildings containing Chelton specialties are also shown.

Beardslee Chandelier Manufacturing Company, Chicago, has just issued the June number of its attractive house organ known as *Beardslee Talks.* This issue contains an interesting article on semi-indirect lighting and some interesting notes relative to the company's business. Loose-leaf inserts containing illustrations and descriptions of new types of fixtures are sent out in connection with this number. It is announced that a description of the company's new factory will appear in the next issue.

Monitor Controller Company, 111 South Gay Street, Baltimore, Md., has issued a folder calling attention to the Monitor system of motor control. It shows the simplicity of this type of control, which involves merely the pressing of buttons to start, stop, reverse, accelerate or decelerate any motor-driven machine. Among the many advantages of this system are that it prevents accidents by giving smooth and perfect operation regardless of careless or unskilled operators.

Sprague Electric Works of General Electric Company, 527 West Thirty-fourth Street, New York City, has issued catalog No. 521 dealing with Sprague flexible steel-armoured hose for air-brake or signal connections between the various cars of a train. This type of connection is built on the general principle so well known in the electrical industry as applied to steel-armored conduit. The bulletin is well illustrated and gives specifications for the various types of hose manufactured.

Elmer P. Morris Iron Works, 90 West Street, New York, N. Y., has issued section three of its illustrated catalog No. 25. This is devoted to plain and ornamental arc and incandescent lamp poles, brackets, pins and fittings. This portion of the catalog comprises 72 pages, very copiously illustrated with half-tone and line cuts of numerous designs, showing entire ornamental posts of many kinds and various brackets, hangers and other detail parts of the equipment. There are also shown two typical scenes in Baltimore in which a large number of Morris ornamental poles are used for a luminous-arc street-lighting installation.

The Peerless Electric Company, Warren, O., has issued bulletin No. 35 devoted to Peerless single-phase motors. These machines are of the induction type with squirrel-cage rotors; they start on the split-phase principle, the starting switch automatically opening when the rotor attains a predetermined speed. In size these motors range from one-thirtieth to one horsepower and in speeds from 1,150 to 3,440 revolutions per minute. They are built for 60-cycle and 40-cycle circuits and for voltages ranging from 104 to 230. The bulletin gives descriptions of their construction and is illustrated with many views of parts of the machines and of complete units.

The Hartford Time Switch Company, 97 Warren Street, New York City, has recently made an ingenious adaptation of its standard type C switch. Ordinarily this switch is arranged to cut out Sunday from its daily operation; by a reversal of a part of this switch it has been arranged so that it does not break the current at all on Sunday but keeps the circuit alive from close of business on Saturday afternoon until the opening on Monday morning. Thus it has been especially adapted for use in connection with the protection of banks and safety-deposit vaults. The switch is automatic and closes the alarm circuits at the end of each business day and opens them again the following morning.

Macbeth-Evans Glass Company, Pittsburgh, Pa., has issued No. 60 of its "Good Light" series. This publication is beautifully illustrated with large half-tone interior views in club rooms, dining rooms, banks, residences, hotels, department stores, etc., in which Macbeth-Evans glassware is generously used. The equipment shown in these many views is largely of the semi-indirect type with ornamental Alba glass bowls. There are also shown installations of Alba glass reflectors, shades, ceiling spheres, etc. This publication is well calculated to bring out the possibilities of highly decorative effect by the use of ornamental illuminated glassware; it also makes a strong plea for good light and shows its economy as well as the general satisfaction resulting from its use.

Standard Underground Cable Company, Pittsburgh, Pa., has issued bulletin No. 700-1. This is a 28-page pamphlet, perforated for insertion in a loose-leaf binder, dealing with cable terminals of the Davis Open-Air type. These are made for all sizes of conductors and for single and multi-conductor cables. They take the place of potheads and end bells that have been in extensive use and which, when intended for outdoor service, were protected by means of weatherproof hoods or boxes. The new type of terminal is compact and entirely self-contained. It protects the insulation of lead-sheathed cables completely from moisture and also protects the emerging conductors from electrical discharges between each other or between any one and ground. The bulletin is very thoroughly illustrated and gives complete descriptions of the various forms of these terminals, tests that have been imposed on them, and dimensions and other data relating thereto. Copies of this bulletin will be sent to those interested in this type of apparatus upon request to the company.

Allgemeine Elektricitats-Gesellschaft, Berlin, Germany, has added some new bulletins to its series dealing with the applications of electricity to farming. Of these No. 7 deals with small motor-driven grain mills. These are of the portable self-contained type and can be moved about conveniently to the most favorable location. No. 11 deals with the use of electricity in the household of the farmer and points out the advantages of electric lighting, cooking, ironing, etc., showing also typical views of rural homes equipped with various electrical appliances, such as the electric flatiron, washing machine, motor-driven sewing machine, heating pad, cream separator, etc. This company has also issued Bulletin 3 of its periodic publications dealing with the products of its cable works at Oberspree. This deals with a new product known in German as rohr-draht, or pipe-wire. This is particularly serviceable in the wiring of old buildings, in which it can be installed as surface wiring, but in out-of-the-way places, thus being concealed.

Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., reports the following orders among the larger ones recently received: Blackstone Valley Gas & Electric Company (through Stone & Webster), one 12,850-kilowatt, 2,300-volt, three-phase, 60-cycle, turbogenerator and three 4,300-kilowatt, 13,000/2,300 volt, single-phase transformers. Oakland, Antioch & Eastern Railway Company, San Francisco, Cal., one 750-kilowatt synchronous motor-generator set consisting of an 11,000-volt, three-phase motor and one 600-volt direct-current generator. Pacific Gas & Electric Company, San Francisco, Cal., three 1,000-kilowatt synchronous motor-generator sets, similar to the foregoing. Pittsburgh Railways Company, Pittsburgh, Pa., one 500-kilowatt 600-volt, direct-current, six-phase, 60-cycle, self-starting rotary converter and one 550-kilowatt 22,000-volt, three-phase, outdoor-type transformers complete with two-panel switchboard. Portland Railway, Light & Power Company, Portland, Ore., one 500-kilowatt synchronous motor-generator set consisting of one three-phase, 60-cycle, motor and 600-volt direct-current generator with direct-connected exciter and starting apparatus. South Covington & Cincinnati Street Railway Company, Covington, Ky., one 300-kilowatt portable substation in which are installed one 300-kilowatt 600-volt direct-current, 60-cycle, self-starting, rotary converter and one three-phase, outdoor-type transformer, complete with two-panel switchboard. Lehigh Valley Transit Company, Allentown, Pa., two 500-kilowatt 600-volt direct-current, 60-cycle, self-starting, rotary converter and six 185-kilowatt 13,200-volt single-phase transformers. Manhattan City & Interurban Railway Company, Manhattan, Kans., one 300-kilowatt and one 200-kilowatt 600-volt direct-current, 60-cycle rotary converter; three 110-kilowatt and three 75-kilowatt 33,000-volt single-phase transformers; two two-panel switchboards; also one outdoor-type transformer substation consisting of a steel tower on which will be mounted three 37.5-kilowatt 33,000-volt, single-phase transformers.

Record of Electrical Patents.

Issued by the United States Patent Office, June 17, 1913.

1,064,706. **Pedal-Operator for Pneumatic Pianos.** J. C. Cake, Chester, Pa. Motor-driven.

1,064,715. **Machine for Cutting Out Mica Between Segments in Commutators.** W. Dickenson, assignor to General Electrc Co. Includes a frame rotatable about the commutator and a longitudinally movable slotting-tool-holding carriage.

1,064,719. **Telephone Trunking System.** E. D. Fales, assignor to Automatic Electric Co., Chicago, Ill. A two-day trunk system with automatic idle-trunk selecting switches at each end.

1,064,722. **Rheostat.** W. G. Gillig, Chicago, Ill. A stationary contact disk is pressed against successive parts of the resistance wire.

1,064,724. **Casing.** M. Guett, assignor to Hart & Hegeman, Hartford, Conn. Has spring tongues for joining a socket cap and shell.

1,064,833.—Base of Separable Attachment Plug.

1,064,726. **Hanger.** W. A. Hall, assignor to General Electric Co. For mounting pole-type transformers or similar apparatus.

1,064,739. **Electrically Heated Soldering Iron.** M. H. Johnson, Utica, N. Y. Relates to the construction of the heating element.

1,064,749. **Electric-Current Controller.** H. W. Leonard, Bronxville, N. Y. A motor control system with automatic accelerating and retarding switches whose action depends on the counter e.m.f. of the motor.

1,064,765. **Electric Controller for Explosive Engines and Associated Mechanisms.** C. O. Pearson, New York, N. Y. A combination electric starting, lighting and ignition system for reversible gasoline engines.

1,064,777. **Electric-Lamp Adjuster.** J. Sachs, assignor to Sachs Laboratories, Hartford, Conn. An insulated clip hooks the cord and holds the socket horizontal.

1,064,805. **System of Telegraphy.** G. Wood, Kansas City, Mo., assignor to Dean Rapid Telegraph Co. Includes a special printing circuit and a reciprocating stylus.

1,064,809. **Motor Controller.** T. E. Barnum, assignor to Cutler-Hammer Mfg. Co., Milwaukee, Wis. Provides for dynamic braking and for inserting resistance in the shunt-field circuit.

1,064,819. **Telegraph Key.** H. C. Dauphinais, Fargo, N. D. Has a special finger piece.

1,064,831 and 1,064,832. **Pull Socket.** H. Hubbell, Bridgeport, Conn. In the first patent the operating lever is pivoted outside the shell; in the second patent inside the shell.

1,064,833. **Separable Attachment Plug.** H. Hubbell. The cap blades have recesses for engaging projections on the base clips.

1,064,834. **Pull Socket.** H. Hubbell. Includes a two-part operating bar.

1,064,838. **Stereoptigraph.** G. W. Kauser, Chicago, Ill. An electromagnet operates the receiving pen.

1,064,846. **Accessory for the Ignition Systems of Internal-Combustion Engines.** M. H. Merrill, Boston, Mass. A spark-plug switch.

1,064,893. **Insulating Compound and Process of Making the Same.** G. F. Dreher, assignor to General Electric Co. Composed of about 46 per cent kaolin, 7 per cent powdered glass, 17 per cent powdered slate and 30 per cent asbestos, soaked in silicate of soda, compressed and fired.

1,064,899. **Train Annunciator.** L. W. Givan, Spring Lick, Ky. The circuits are controlled by the train dispatcher and also by the passage of trains.

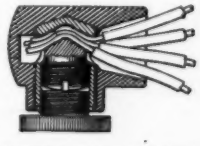
1,064,900. **Insulated Rail Joint.** L. Griffith, Yonkers, N. Y. Has insulation between the splice bars and rails.

1,064,911. **Illuminated Sign.** R. P. Jarvis, assignor of two-thirds to A. F. Lutz and one-third to Many Colored Electric Co., Beloit, Kan. An electric sign with a reflector at each end.

1,064,915. **Means for Producing Ignition Spark.** A. Kazenmaier, assignor to Firm of Robert Bosch, Stuttgart, Germany. A high-tension electric ignition system for explosive engines.

1,064,920. **Connector for Electric Wires.** D. R. Lovejoy, Freneau, N. J. The wire-receiving hole has a concave bottom and the clamping screw has a convex tip.

1,064,926. **Signaling Means.** J. J. Nielsen, Chicago, Ill. Relates to a circuit-closing switch box.



1,064,920.—Wire Conductor.

1,064,927. **Indicator-Operating Mechanism.** E. J. Pace, assignor to National Street Station Indicator Co., Los Angeles, Cal. Points along the track close the switch for the indicator-actuating mechanism.

1,064,936. **Wire-Stretching Device.** A. D. Scott, assignor to Varley Duplex Magnet Co., Jersey City, N. J. For a winding machine.

1,064,955. **Connecting Device.** E. G. K. Anderson, assignor to Benjamin Electric Mfg. Co., Chicago, Ill. A separable lamp receptacle with bayonet connections between base and shell.

1,064,957. **Electrical Connecting Apparatus.** G. A. Betulander, Södertörns Villastad, Sweden. A remote-control switch.

1,064,976. Electric Signaling System. E. R. Lundius, Seattle, Wash. Program clock.

1,064,981. System and Method of Producing by Means of Combustion Engines, Electric Current. W. A. T. Müller, Berlin, Germany. Comprises several units, each consisting of a dynamo and engine; first one unit is started and then the next one is excited so as to cause it to act as a motor and start its respective engine.

1,064,983. Electric-Bath Cabinet. T. E. Murray and G. K. Jessup, New York, N. Y.; said Jessup assignor to said Murray. Has folding sides carrying tubes to which incandescent lamps are secured.

1,064,985. Electric Cutout. T. E. Murray, Jr., assignor to T. E. Murray, Sr., New York, N. Y. Has a lever for moving the fuse arms into and out of engagement with the contacts.

1,064,991. Electrode Holder. H. J. Potts, Kansas City, Mo. Includes a helical tension spring.

1,064,992. Metallurgy of Zinc. A. L. J. Queneau, assignor to Queneau Electric Zinc Furnace Co., Philadelphia, Pa. Includes an electric furnace with rotary chamber.

1,064,997. Signaling System. H. O. Rugh, Sandwich, Ill., assignor to Hall Switch & Signal Co. A telephone train-dispatching system with step-by-step selector.

1,064,998. Telephone-Call Recorder. H. K. Sandell, assignor to H. S. Mills, Chicago, Ill. Includes a clock movement started at the beginning of a call and an overtime register.

1,065,009. Controller. P. S. Turner, assignor to Westinghouse Electric & Mfg. Co. A double-drum controller providing for dynamic braking.

1,065,014. Coin-Actuated Telephone Attachment. G. P. Wriborg, Athelstane, Wis. Insertion of a coin releases a latch.

1,065,015. Resistance. William R. Youmans, assignor to Jeffrey Mfg. Co., Columbus, O. A ribbon resistance is wound back and forth between two spring-separated frame ends.

1,065,037. Heating Unit. B. Falkenburg, Ontario, Cal. Wire is wound on an insulating sheet between two semi-cylindrical metal cores.

1,065,068. Protector for Telegraph and Telephone Cross-Arms and Pins. H. G. Newell, Le Raysville, Pa. A flat flanged ring fits around the pin at the top of the arm.

1,065,085. Paper-Lifting Device. C. E. Steere, Chicago, Ill. Motor-driven.

1,065,090. Apparatus for Uniformly Coating Strips of Metal, Wire, and the Like Under Continuous Action. F. Werth, Milan, Italy. An electrolytic bath with circulating electrolyte.

1,065,091. Automatic Turntable. J. H. Wittmann, Kansas City, Mo., assignor to Pitless Auto Turntable Co. Motor-driven.

1,065,094. Lighting-Fixture. L. W. Young, New York, N. Y. A special vented globe about a cluster of lamps.

1,065,114. Electric Railway Signaling System. F. P. Cremona, Baltimore, Md. A block system with two pairs of main circuit wires.

1,065,131. Sealing-Tool. L. V. V. Hull and H. B. Moorehead, McComb, O. Has an electric sealing-wax heater.

1,065,134. Self-Lighting Kinematographic Apparatus. E. A. Ivatts, assignor to Compagnie Generale de Phonographes, Cinematographes et Appareils de Precision, Paris, France. Includes an electric generator, a film-actuating shaft to drive the generator and an electric lamp supplied by the generator for illuminating the film.

1,065,141. Projector Carbon. J. F. Kerlin, assignor to National Carbon Co., Cleveland, O. An arc-light carbon with a core and an external groove parallel to the core.

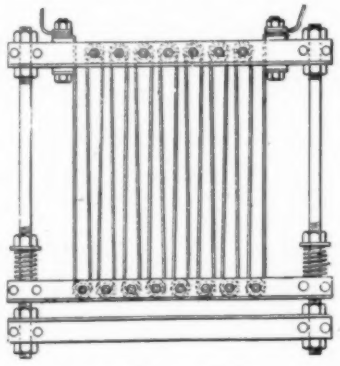
1,065,147. Miner's Lamp. S. Koroly, Smithdale, Pa. An incandescent lamp and battery mounted on the cap.

1,065,148. Electric Cooker. C. C. Lillibridge, Hutchinson, Kan. Has a double-walled casing, a double cover, with water seal and a heating element at the bottom of the inner casing.

1,065,151. Electric Signaling System. R. H. Manson, assignor to Dean Electric Co., Elyria, O. A vehicle signaling system with a main signal and a second signal in a branch circuit.

1,065,155. Electric Fixture. W. McCanse, Hobart, Okla. A drop lamp adjuster with a horizontally swinging arm on which a radially moving cord-holding carriage moves.

1,065,190. Strain-Relief Device. T. J. Tobin, assignor to Bryant Electric Co., Bridgeport, Conn. In the cap of a pendent socket is a slightly flexible fiber plate with a pair of gripping tongues to hold the cord.



1,065,015.—Resistance.

1,065,192. Engine Stop and Recording Device. Asa F. Tyler, Merlin, Ore. Combined with an explosive engine and its ignition circuit is a clock, a speed governor and a governor-controlled means for breaking the ignition circuit and stopping the clock.

1,065,210. Artificial-Light Printing-Machine. E. J. Brogan, Yonkers, N. Y., assignor of one-third to J. D. Reilly. A blue-printing machine with electric lamps and a motor for operating the rollers.

1,065,226. Steam-Heating System. A. C. Durdin, Jr., assignor to Chicago Pump Co., Chicago, Ill. Includes a motor-driven pump and automatic control therefor.

1,065,246. Water-Purifying Apparatus. S. Held, assignor to Held Co., Chicago, Ill. Turning on the water causes suction in an aerating pipe and this close the circuit of an ozonizer.

1,065,302. Means for Transferring Load from One Generator Station to Another. E. F. Dutton, assignor to General Electric Co. Includes automatic circuit-breakers between each station and its load circuits, other automatic breakers for connecting the load circuits and selective interlocking means between the two sets of breakers.

1,065,326. Apparatus for Making Castings. H. P. Marshall, Glen Ridge, N. J. A vacuum electric furnace.

1,065,327. Spark-Plug Connector and Switch. C. E. Semple, Jr., Youngstown, O. Adjacent the plug is a short-circuiting switch.

Patents That Have Expired.

Following is a list of electrical patents (issued by the United States Patent Office) that expired June 23, 1913.

562,365. Alternating-Current Motor. E. Arnold, Zurich, Switzerland.

562,366. Electric Motor and Dynamo. E. Arnold.

562,396. Secondary Battery. R. J. Gulcher, Charlottenburg, Germany.

562,398. Electric Locomotive. J. C. Henry, Westfield, N. J.

562,400 and 562,403. Electric Furnace. W. R. King and F. Wyatt, New York, N. Y.

562,404. Electric Furnace. W. R. King.

562,429. Electrical Advertising Apparatus. C. E. Skinner, Pittsburgh, Pa.

562,431. Electrical Releasing Device. C. A. Stearns, Watertown, Mass.

562,435. System of Current Supply for Telephone Circuits. J. S. Stone, Boston, Mass.

562,453. Electric Railway. H. Brandenburg, Chicago, Ill.

562,463. Automatic Relief-Valve for Electric Pumps. M. W. Hall, Plainfield, N. J.

562,483. Traveling Contact or Plow for Underground Electric Railways. S. L. Phillips, Washington, D. C.

562,484. Traveling Contact for Underground Electric Railways. S. L. Phillips.

562,498. Power-Transmitting Mechanism. E. A. Sperry, Cleveland, O.

562,499. Coupling for Electric or Other Power Transmission. E. A. Sperry.

562,500. Coupling Device. E. A. Sperry.

562,501. Electric Controller. E. A. Sperry.

562,502. Electric Locomotive. I. E. Storey, Boulder, Colo.

562,527. Rheostat or Electric Heater. W. S. Hadaway, Jr., New York, N. Y.

562,541. Automatic Operation of Electric Generators. F. E. Kinsman, Plainfield, N. J.

562,564. Bank of Electromagnets. C. E. Allen, Salem, Mass.

562,591. Apparatus for Operating Trolley Arms. P. J. Dowling, Waterbury, Conn.

562,607. Electric-Locomotive Truck. W. P. Henszey, Philadelphia, Pa.

562,609. Electric Arc Lamp. D. Higham, Boston, Mass.

562,647. System of Electrical Distribution. L. K. Oppenheimer, Cincinnati, O.

562,658. Electric Switchboard and Circuit-Maker. A. L. Pratt, Kalamazoo, Mich.

562,673. Electric Igniter for Gas or Hydrocarbon Engines. F. M. Spaulding, Kalamazoo, Mich.

562,680. Electric Meter. A. G. Waterhouse, Hartford, Conn.

562,686. Alternating-Current Motor. M. J. Wightman, Lynn, Mass.

562,745. Controlling Mechanism for Electric Motors. R. C. Smith, Yonkers, N. Y.

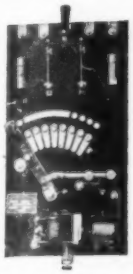
562,766. Electric Railway. R. M. Hunter, Philadelphia, Pa.

562,775. Electric Lighter. H. E. Rider, Brooklyn, N. Y.

562,776. Process of Utilizing Material of Worn-Out Secondary Batteries. W. L. Silvey, Dayton, O.

I-C CONTROLLING — DEVICES —

The Mechanical Details



Ratchet Type Universal Compound Starter and Regulator with no voltage and over-load release. Mounted on Marbleized slate panel with knife switch and base ready for connections.

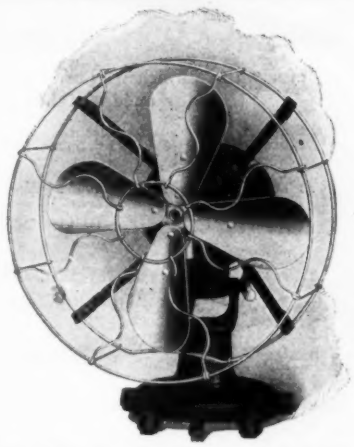
of I-C Controlling Devices have been so worked out as to make them stronger, more reliable, and more "Fool-Proof" than other devices with which they come in competition.

This fact is apparent even in the illustration of our product and is being demonstrated constantly wherever they are used.

Exclusive patent designs of our own, such as the renewable ratchet bar on our speed regulators, easily renewable segments, unbreakable stamped steel levers, adjustable contact brushes on all of our starters and controllers, put them one step in advance of all other devices made for similar purposes.

If you are a Motor Manufacturer, Jobber, Dealer, Supply or Repair man, a copy of our catalog should be on your desk. Write for one now and it will be sent you by return mail.

INDEPENDENT ELECTRIC MFG. CO.
MILWAUKEE



PEERLESS FANS

Built on Honor
Sold on Merit

All Types, All Sizes, All Guaranteed

Write for 1913 Catalog today

Peerless Electric Company
Warren, Ohio

Motors, Generators, Rotary Converters, Exhaust Fans

Satisfy Yourself

in your desire to procure only the best obtainable by demanding good quality, efficiency and economy in first cost. All of our material is designed with an expert knowledge of exact service conditions, and is produced only from the best materials and workmanship obtainable. Our five year guarantee assures you of our responsibility.

Ask for Our Blue Catalogue and Pole Top Switch Bulletin

Electrical Engineers Equipment Co.
10-12 N. Desplaines St., Chicago, Ill.
Northern Electric & Mfg. Co., Limited, Canadian Distributors

Electrical Supplies

of any kind furnished by us at the lowest market prices. The following list will give an idea of the material and supplies carried in stock.

Cut-outs	Motors	Switches	Globes
Portable Lamps	Luminous Radiators	Hylo Lamps	Sockets
Washing Machines	Wires	Toasters	Heating Pads
Brushes	Dynamos	Cables	Vacuum Cleaners
Flat Irons	Chafing Dishes	Dynamo Parts	Carbons
Arc Lamps	Cords	Cigar Lighters	Curling Iron Heaters

Miniature, Decorative, Tungsten and Carbon Lamps

Commonwealth Edison Company

Phone Randolph 1280 120 West Adams St.

CHICAGO

COMBINE ENDURING QUALITY WITH ECONOMY AND YOU HAVE

MICANITE

TRADE MARK NAME REGISTERED

Samples and prices on request

The most widely known and extensively used insulating material in the commercial world. It is a non-oozing soft mica commutator insulation free from superfluous bonding material.

MICA INSULATOR COMPANY

NEW YORK and CHICAGO

11

MICABOND

THE STANDARD MICA INSULATION

PRICES QUALITY RESULTS **RIGHT**

We manufacture everything in Mica for electrical work.

Prompt Shipments

May we mail you our latest catalog?

CHICAGO MICA COMPANY

Main office and factory - Valparaiso, Indiana

Chicago Office - 614 W. Adams St. San Francisco Office, 247 Minna St.
Cleveland Office - 404 Caxton Bldg. Denver Office - - 407 14th St.
St. Louis Office - - 1124 Pine St. Toronto Office - 702 Lumsden Bldg.
Birmingham Office, 1314 Empire Bldg. Baltimore Office, 209 Equitable Bldg.
A. Hall Berry, 97 Warren St., New York, N. Y.

"UNION" KEY SOCKETS

embody the only improvement made in key sockets in years. The porcelain part has been especially strengthened. Our method of attaching shell and cap is not approached by any other type; it permits instant changing of shells. N. E. C. Standard, Edison Base, 250 volts.

"Union Made Means Well Made"

Send for Prices and Samples

UNION ELECTRIC CO.

Hamilton Ave. Trenton, N. J.

P&B

Yes, we know you are familiar with our P. & B. Compound and P. & B. Insulating Tape, but

Have you examined our Insulating Varnishes?

(Baking and Air Drying)

Send for our Booklet No. 3, describing interesting tests and methods for best insulation.

WRITE FOR BOOKLET No. 3

The Standard Paint Company

100 William St., New York City

Chicago Boston Denver

Insulated Staples

5 Sizes

Pat. Nov. 1900

BLAKE Specialties

STAPLES best for wiring.
TUBE FLUX best Flux for soldering.

FULL SIZE OF TUBE, 1" x 5"

BLAKE SIGNAL & MFG. CO. Write for samples 246 Summer St., Boston, Mass.

WILLARD STORAGE BATTERIES

For ALL PURPOSES

Manufactured by

THE WILLARD STORAGE BATTERY CO.

CLEVELAND, - OHIO

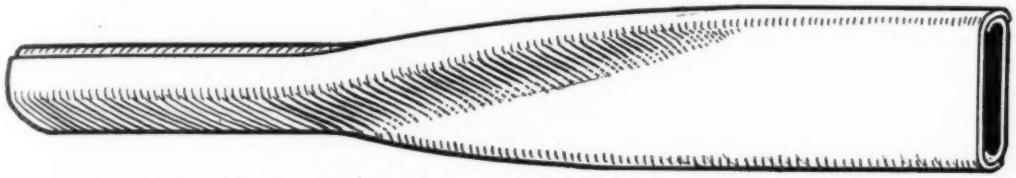
"NATIONAL" METAL MOLDING can be bent or offset very easily FLATWISE, the only feature to be borne in mind being that it must be done while the base and capping are *snapped together.*

But "National" Metal Molding cannot be bent or offset EDGEWISE, any more than can any other flat material.

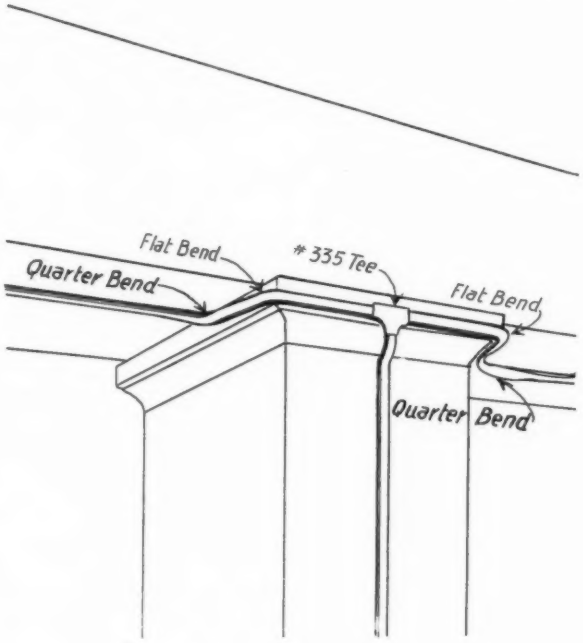
For this reason where "National" Metal Molding has been run along on the face of a beam, for example, and an obstruction in the shape of a pillar has been encountered, most wiremen have stopped and broken around the pillar with four No. 336 Flat Elbows and short lengths of Metal Molding.

There is a much easier way of getting around such obstructions, however.

This easier way is by twisting or *"quarter bending"* the Molding—twisting it up on edge.



Here is a full size drawing of a piece of "National" Metal Molding which was *"quarter bent"* by a Pittsburg wireman. He used a common wrench and a pair of small gas pliers to do it.



Here is a sketch showing a characteristic application of *"quarter bending,"* in combination with flat bending, for breaking around just the kind of obstruction mentioned above—a pillar.

This sketch isn't of an imaginary job done by an imaginary wireman. It has been made by a man who has seen many jobs of just this kind done by many wiremen who have taken hold of "National" Metal Molding in earnest and who have found that it is easier, quicker and more satisfactory to handle than conduit.

Men who know will tell you that "National" Metal Molding is a Legitimate Contractor's, a Legitimate Wireman's Job—not a janitor's or a "handy man's."

IS YOUR NAME on our mailing list so that you will receive copies of the new catalogue, wall chart and data book, all three of which will soon be published?

National Metal Molding Company

Fulton Building Pittsburg, Pa.

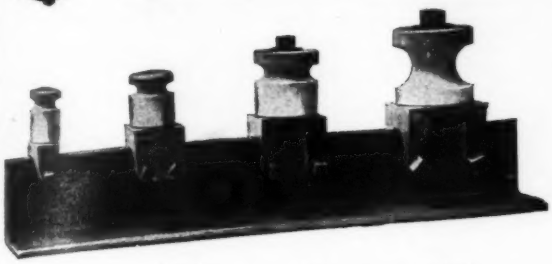
The Standard
HEAT RESISTING
Moulded Insulation

Exclusively specialists in moulded insulation. You can safely trust us with your new *designs* for *estimate.* *You* also get the *benefit* of our *long* and *varied experience* and *strong basic patents.*

Hemming Manufacturing Company
Garfield, New Jersey

Best Prices—Prompt Service—Time and Money Saving Features Distinguish

STEEL CITY SPECIALTIES



1 inch 1¼ inch 2 inch 2½ inch

Showing one of each size of Supports with Insulators attached mounted on Section of Angle Iron

Wherever open steel framework construction is encountered, use

"Universal" Insulator Supports

provided you are in business to make money.

Permanent work is secured without the use of special rigs, wood blocks, strips, etc., yet when wiring changes are required they can easily and cheaply be made by merely moving the supports to the desired new locations. Durable—best malleable iron.

Outlet Boxes and Covers

Our improvements the only progress made in

15 Years

making our goods the most practical on the market. "Nimble Knock-outs," easy to take out when wanted, stay in until wanted out. Flanged ears that will not break off or pull out. Perfect adjustment of cover. Sherardized or enameled finish.

STEEL CITY ELECTRIC CO., Pittsburgh, Pa.

Simplicity Itself, but Thief-Proof

Just as long as the difference in price between tungsten and less efficient lamps is an incentive to theft, just so long will the item of stolen lamps retard the general use of Mazda or other types of high efficiency lamps, unless protection is secured through the use of *the* safety device, the

Shurlok

The Socket That Locks

The first cost of Shurlok attachments to any of the regular P & S sockets is low. Any hotel, office building, public building or industrial plant will save this first cost in from 90 to 120 days. Get after your prospects.

101

Pass & Seymour, Inc.
Solvay, N. Y.

Please send free sample Shurlok Sockets.

_____

_____

_____

Sample free. Ask any jobber or write.

PASS & SEYMOUR, Inc.,
SOLVAY, NEW YORK

178 Fulton Street, NEW YORK CITY

700 W. Jackson Blvd. CHICAGO, ILL.

Rialto Bldg., SAN FRANCISCO, CAL.

B. K. Sweeney Electric Company, Denver, Sales Agents

"Ask Kirk" About Clay Conduit

Grand Ledge Clay Product Company

Grand Ledge, Mich.

The largest Clay Conduit factory in the Central States.

Vitrified Clay Conduit

Multiple, Single, Round, Square.

E. F. KIRKPATRICK

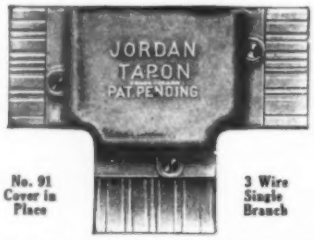
E. F. Kirkpatrick

General Sales Manager
436 First National Bank Bldg.
Chicago

"Grand Ledge" Conduit meets every requirement in underground construction.

"Grand Ledge" Conduit makes the subway.

Dry as the Desert—Permanent as Gibraltar



No. 91 Cover in Place

3 Wire Single Branch

JORDAN TAP-ONS

Save time and money on wood molding jobs.

Approved by the Underwriters and all Inspection Bureaus

For two and three wire branches and any combination thereof. The ragged edges of the capping are overlapped by the porcelain cover of the Tap-On, making a neat and finished job.

Write for Catalog

JORDAN BROS., Inc.

74 Beekman St. New York

Friction Tape, Splicing Compound, Armature Tape

CLIFTON MANUFACTURING CO., Boston, Mass.
Warehouses: Boston, New York City, Buffalo, Chicago

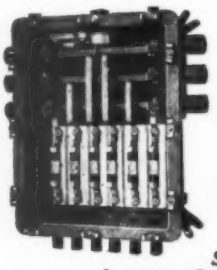
W. R. OSTRANDER & CO.

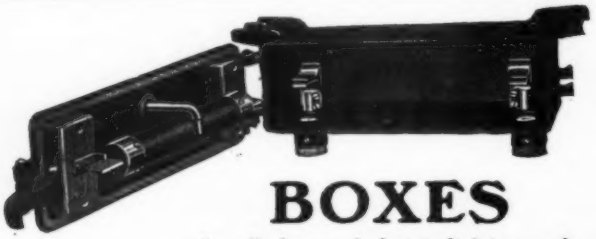
22 Dey Street
NEW YORK

Factory: { 1431 to 1439 De Kalb Ave. Brooklyn, N. Y.

Send for New 700-Page Catalogue, Dept. W.

Manufacturers and Dealers in all kinds of
Electrical Supplies
Bells
Annunciators
Speaking Tubes, Etc.





BOXES

for all classes of electric lighting work:

Service Switches and Fuse Boxes, Branch Boxes, Transformer and Junction Cut-Outs, Junction Switches and Subway Boxes. D & W Boxes have been tested in actual service since 1897 and are now generally adopted as standard. Write for Circular No. 114.

D & W FUSE CO., Providence, R. I.

CONDUIT

TRADE MARK

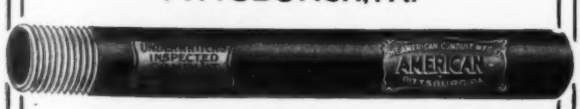
That "Makes" the Job

"GALVANITE"
ELECTRO GALVANIZED
RIGID
CONDUIT

"AMERICAN"
ENAMELED
RIGID
CONDUIT

"WIREDUCT"
NON-METALLIC
FLEXIBLE
CONDUIT

THE AMERICAN CONDUIT MFG. CO.
PITTSBURGH, PA.



Strongest and Most Durable Insulation
of its Kind

J-P Bakelite Insulation has a transverse strength of 13,000 LBS. PER SQUARE INCH. It is exceedingly tough, therefore won't chip or break. Perfectly resists temperatures up to 300° F. and has a dielectric strength of 250 volts per mil. If you want an insulating material that has the appearance of highly polished hard rubber—but that has many times its strength and durability—specify

J-P BAKELITE Molded Insulation

shape. A Bakelite insulating piece is one homogeneous mass. No joints—no weakness.

This insulation is especially adapted for molding complicated pieces that must withstand unusually severe conditions. It is molded under tons of pressure into practically any

J-P Bakelite is light in weight, immune to water, oils, and other liquids. Won't swell or shrink from moisture or alternate heating and cooling. Takes a very high finish, and retains it permanently.

Write nearest Branch for Samples and full information.

H.W.Johns-Manville Co.

Manufacturers of Asbestos and Magnesia Products **ASBESTOS** Asbestos Roofings, Packings, Electrical Supplies, Etc.

Albany	Cleveland	Louisville	Philadelphia
Baltimore	Dallas	Milwaukee	Pittsburgh
Boston	Detroit	Minneapolis	San Francisco
Buffalo	Indianapolis	New Orleans	Seattle
Chicago	Kansas City	New York	St. Louis
Cincinnati	Los Angeles	Omaha	Syracuse

THE CANADIAN H. W. JOHNS-MANVILLE CO., LIMITED
Toronto Montreal Winnipeg Vancouver

For Great Britain and Continent of Europe:
TURNERS & MANVILLE, LTD.,
Hopetoun House, 5 Lloyds Ave., London, E. C.

2031

DIRECT CURRENT GENERATORS
Bulletin No. 1106

D. C. and A. C. MOTORS
Bulletins Nos. 6046 and 2196

14 YEARS SUCCESS THE RECORD OF

TRADE
BX CABLE
MARK

HOT GALVANIZED FLEXIBLE STEEL ARMORED

RUST PROOF AND MOISTURE PROOF

A Coil of Greenfield Flexible Steel Armored Conductors

SAVE MONEY
AND
REDUCE FIRE HAZARD
ON EVERY INSTALLATION

BX Cable presents the most practical solution of the wiring problem in new or existing buildings. It is far superior to all other flexible steel armored cables on the market, eliminating all danger from chafed and exposed conductors. The steel armor permits an unusual degree of flexibility, yet is more likely to turn a nail than commercial pipe.

BX is not only approved by the Underwriters Laboratories, Inc., and all Municipal Boards, but has stood the most severe service tests.

Be absolutely sure of making no mistake in selecting the most reliable cable by specifying and insisting on obtaining BX.

Furnished in coils in lengths convenient for use.

GREENFIELD FLEXIBLE STEEL CONDUIT
Single and Double Strip

SPRAGUE STAMPED STEEL BOXES and COVERS

GREENFIELDUCT A Rigid Conduit
Hot Galvanized on Both Exterior and Interior

SPRAGUE FITTINGS AND TOOLS

Write Today for Conduit Products Catalog No. 4396

SPRAGUE ELECTRIC WORKS
OF GENERAL ELECTRIC COMPANY

Main Offices: 527-531 West 34th Street, New York, N. Y.

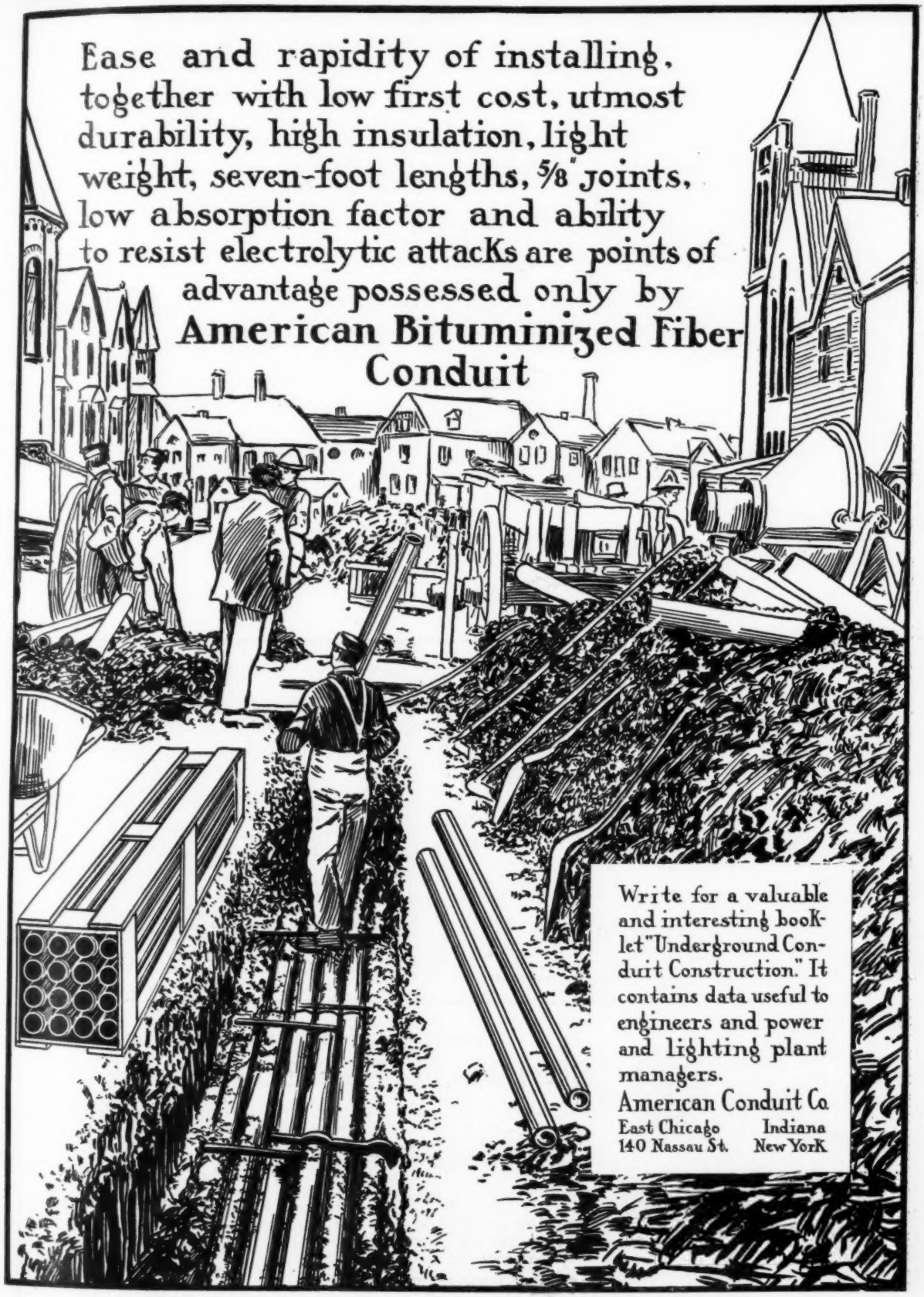
BRANCH OFFICES:
Chicago, Atlanta, Philadelphia, San Francisco, Boston, St. Louis, Baltimore, Milwaukee, Pittsburgh, Seattle

ELECTRIC FANS
Catalog No. 3276

ELECTRIC HOISTS
Pamphlet No. 9016

Ease and rapidity of installing, together with low first cost, utmost durability, high insulation, light weight, seven-foot lengths, 5/8" joints, low absorption factor and ability to resist electrolytic attacks are points of advantage possessed only by

American Bituminized Fiber Conduit



Write for a valuable and interesting booklet "Underground Conduit Construction." It contains data useful to engineers and power and lighting plant managers.

American Conduit Co.
East Chicago Indiana
140 Nassau St. New York

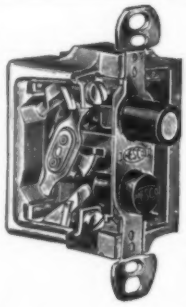
G. M. Gest

Conduit

Engineer & Contractor

Executive Offices
277 Broadway
NEW YORK

Cincinnati *San Francisco*
Chicago *Montreal*



The Flush Push Button Switch

for the Jobber, Dealer, Contractor, Architect, Builder, Electrician, bears the Trade Mark

MESCO

on the cross bar. It is our guarantee of mechanical and electrical perfection.
Ask for descriptive circular and price list.

MANHATTAN ELECTRICAL SUPPLY CO.

New York 17 Park Place | Chicago 114 S. Fifth Ave. | St. Louis 1106 Pine St. | San Francisco Office 604 Mission St.

Permanent Efficiency Plus Durability

SCHWARZE ELECTRIC BELLS

We make one grade of electric bells only—the very best that can be produced for all positions where an electric bell is desired and for all conditions of service.

No. 22, Standard Bell, illustrated herewith, is for use on Battery or High Tension, Direct Current Circuits. The bell is entirely insulated from the frame; is fully approved by the Underwriters; is remarkable for its quick response and instant stopping and is (like all Schwarze Bells) absolutely guaranteed.

Write for our Catalog—it is complete in its description and illustration of our high grade line.

SCHWARZE ELECTRIC CO. **Adrian, Mich.**

DURADUCT

REG. U. S. PAT. OFF.

The Indestructible, Inseparable
Non-Collapsible, Easy-Fishing

STANDARD CONDUIT

EVEN in extreme low temperatures, you can't affect the interior surface of Duraduct by looping, kinking, flattening, bending or smashing. The fabric is one inseparable wall—it **can't** blister.

Duraduct has an outer surface of woven cotton—an intermediate layer of hard twisted insulating paper—a woven cotton interior surface—and all three parts are so interwoven as to form a single wall-structure.

Duraduct has great tensile strength, and is very flexible. It is moisture-proof and flame-proof.

Its inner roller-surface offers only three inches of friction surface to the foot. Contrast this with the twelve inches of friction surface offered by every foot of conduit with smooth inner surface—doesn't it stand to reason that fishing is bound to be easier?

Duraduct is made in all standard sizes—ask for sample. The real Duraduct is distinguished by the black dotted line—look for it, it is your protection.

TUBULAR WOVEN FABRIC CO.

Pawtucket, R. I.

General Sales Agent: A. HALL BERRY
97 Warren St., New York

Western Sales Manager: JAMES WOLFF
309 South Desplaines St., Chicago, Ill.

"UNDERGROUND" BURDENS LIFTED

Our Slogan is

"From Specifications to Lights On"

That means that you are not to be burdened with the cares of such work.

We assume every detail of the work of underground installation, whether a change from overhead to underground system, or new installation.

We are prepared to install complete systems ready for operation, and at the same time work a material saving for Electric Light, Power, High Tension, Telegraph, Street Railway Feeder Systems, etc. Write us today.

J. W. TURNER IMPROVEMENT CO., Des Moines, Iowa

The Greatest Advance in the Solution of the Lighting Problem

since the invention of the carbon lamp about 20 years ago, has been made by the

INDEPENDENT Ductile Drawn Wire Tungsten Lamp

It has greater utility than the carbon lamp.

If the filament is broken, it will frequently fuse again, if the globe be gently tapped and will burn as before, while a broken carbon filament ends the usefulness of the lamp.

It gives a white light, resembling daylight more closely than anything yet produced by human ingenuity.

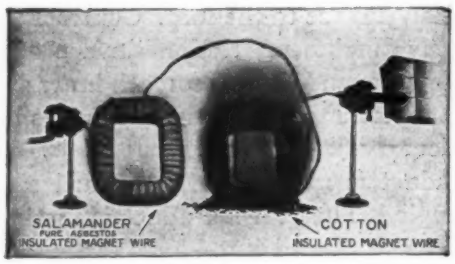
There is no deterioration in quality of light, whereas the carbon lamp gives a weaker and yellower light the longer it burns.

It effects a saving of 75 per cent in current for the same candlepower.

Field and Armature Coils Subjected to Heavy Overloads Made Permanently Fire-Proof with

SALAMANDER

Pure Asbestos Insulated Magnet Wire



Showing the result of heat on cotton-insulated coil, and its non-effect on Salamander asbestos-insulated coil.

Make your machinery that is subjected to heavy overloads or high temperatures safe at all times with Salamander Fireproof Wire. Constructed of the indestructible asbestos—it gives the greatest protection at the smallest cost at all times. Indestructible equipment is a necessity—Salamander Fireproof Wire makes yours a reality, is approved and used by the United States Government and in many of the largest Central Stations in the country.

Write for booklet. Yours for the asking.

Independent Lamp and Wire Co.

1733 Broadway - - - - New York

Works: York, Pa., and Weehawken, N. J.

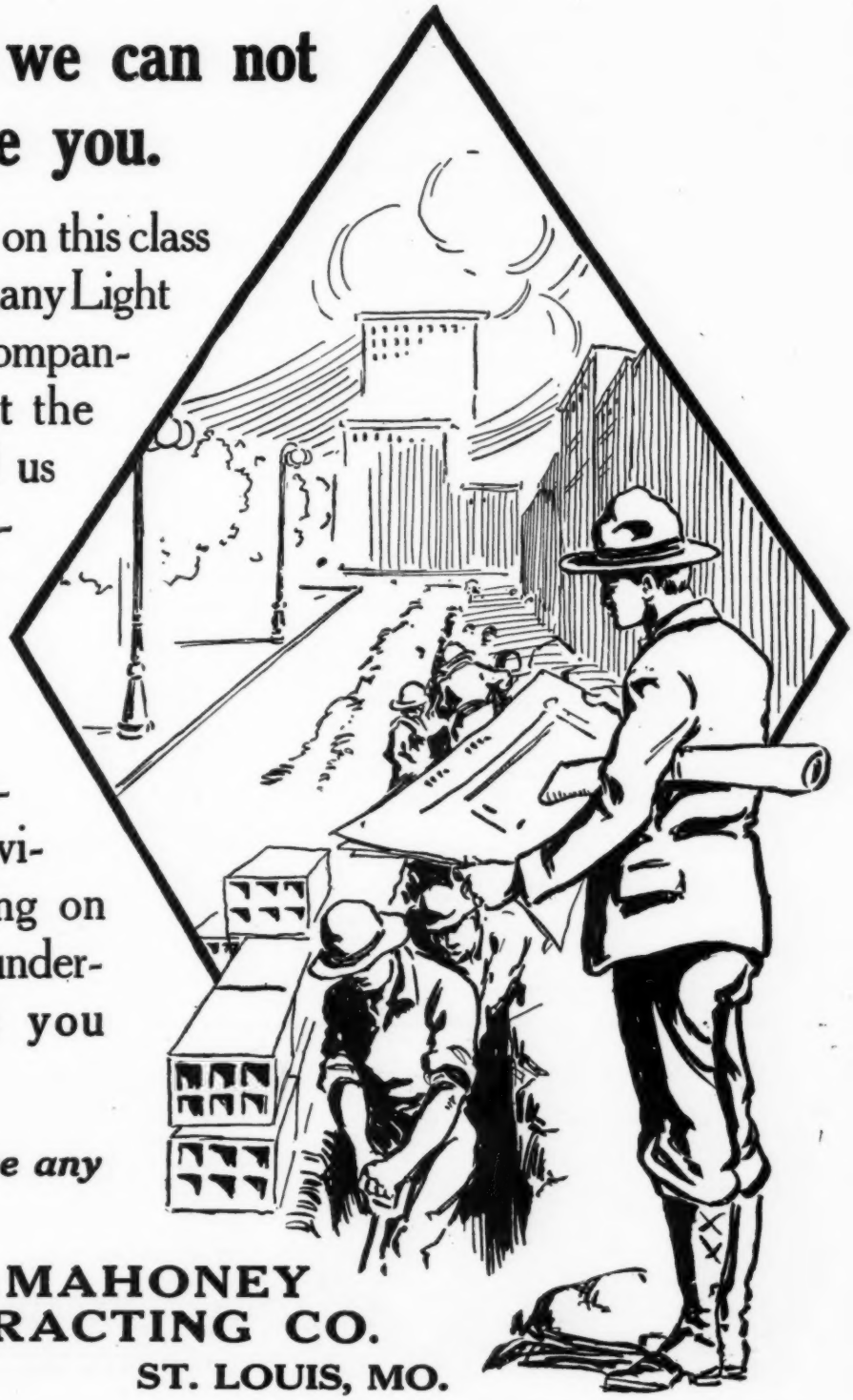
THERE'S NOT AN INSTALLATION UNDERGROUND

of which we can not relieve you.

We specialize on this class of work, and many Light and Power Companies throughout the country regard us as an indispensable and comprehensive caretaker.

We should appreciate the privilege of figuring on any class of underground work you decide to do.

Do you purpose any NOW?



GRANER-MAHONEY CONTRACTING CO.

ST. LOUIS, MO.

"NICHROME"
answers the Heating Question

Third

Do you know why the best informed engineer always specifies "Nichrome?" One of many considerations is its uniformity.

?

DRIVER-HARRIS WIRE CO.
Main Office and Works, Harrison (Newark), N. J.
Western Branch: Washington Blvd. and Jefferson St., Chicago, Ill.

...The...
National Conduit and Cable Co.
EXECUTIVE OFFICES
41 Park Row - - - New York, N. Y.
Manufacturers of
Bare Copper Wire and Cable
Weatherproof Wires and Cables
Paper Insulate Cables
For Power, Telephone and Telegraph
Boston Philadelphia Chicago San Francisco

TRADE M MARK
Look for the Diamond M

MOORE
MAGNET
WIRE

ALFRED F. MOORE
200 N. Third St. — PHILADELPHIA
NEW YORK CLEVELAND CHICAGO BOSTON
CHATTANOOGA NEW ORLEANS

WIRES

Show Window Cord Lamp Cord
LOWELL INSULATED WIRE CO.
Lowell, Mass.
N. E. C. S. Wire Telephone Wire

H. N. FENNER, Pres. J. F. BLAUVELT, Agt. RUSSELL W. KNIGHT, Treas.
New England Butt Company
MANUFACTURERS OF
Machinery for Insulating Electrical Wires
Braiding, Taping, Winding, Twining, Cabling, Stranding, Polishing and Measuring Machines.
CABLE COVERING BRAIDERS FINE CASTINGS A SPECIALTY
304 Pearl Street, PROVIDENCE, R. I., U. S. A.

PENN NEW CODE WIRES AND CABLES
Made in accordance with the new N. E. C. Rules taking effect January 1st, 1912. Ask for copy of specifications covering this revision.
HAZARD
MANUFACTURING CO.
Wilkes-Barre, Pa.
New York Pittsburg Chicago

Roebling Magnet Wire
consists of specially drawn and annealed copper wire, soft and true to gauge, covered with a smooth and uniform insulation. Furnished round, flat, square and in strands.
John A. Roebling's Sons Co.
Trenton, N. J.

Diamond

Rubber Covered Wires and Cables

provide double sure insulation.

Most Efficient—Most Durable

Provide the largest margin of safety. The most exhaustive underwriters' tests prove it.

THE B. F. GOODRICH COMPANY

AKRON, OHIO Branches in all leading citie

Belden Rubber-Covered Wire

1911 N. E. C. S.

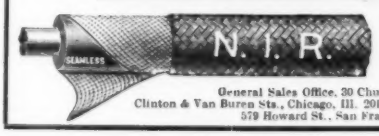
One Conductor White—One Black

Immediate Shipments from a Large Stock

BELDEN MANUFACTURING COMPANY

Offices and Factory
2304 So. Western Ave,
CHICAGO

Rubber-Covered Wires and Cables
FOR EVERY ELECTRICAL REQUIREMENT



NATIONAL INDIA RUBBER CO.
Factory:
Bristol, R. I.

General Sales Office, 30 Church St., New York
Clinton & Van Buren Sts., Chicago, Ill. 201 Devonshire St., Boston, Mass.
579 Howard St., San Francisco, Cal.

Buy Emerson Fans

at more favorable prices and conditions than before. Sell them at higher prices with the Emerson 5 year guarantee.

Catalog, prices and contracts sent to dealers on request.

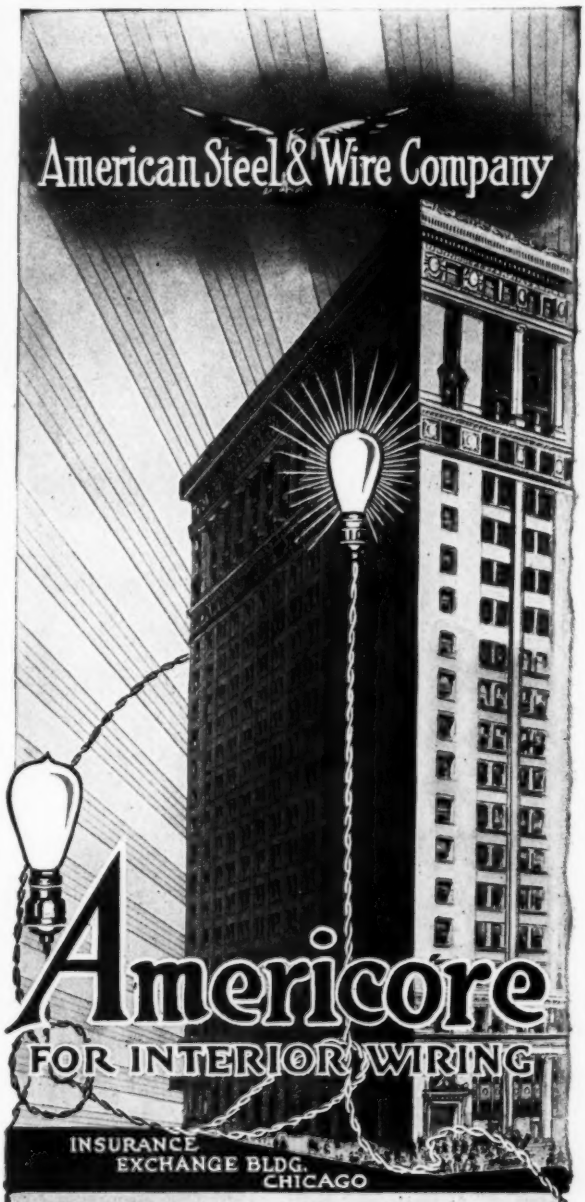
The Emerson Electric Mfg. Co.

50 Church Street, New York City
2032 Washington Avenue, St. Louis, Mo.

MAGNET WIRE

WIRE
OF THE HIGHEST QUALITY
Kellogg Switchboard & Supply Co.
Kansas City Chicago San Francisco

KELLOGG



OVER 200,000 feet of our Americore rubber covered wire used in this building.

Every foot is carefully inspected by us in the various stages of manufacture, and when completed is finally examined and labeled under the direction of the Underwriters' Laboratories.

We are prepared to furnish this wire in all sizes and conductors, both solid and flexible, from warehouses conveniently located for quick delivery to all parts of the country.

Chicago New York Cleveland
Worcester Pittsburgh Denver

THE standard of service and quality in wire making established by us in 1870 has been rigidly maintained as the keystone of our business policy.

The intervening years of experience have seen no change in that policy, but have brought many changes in the methods of manufacture, each change a step forward in giving to the electrical industry wires and cables of uniform excellence and unsurpassed value.

Bare and Insulated Wires and Cables
Low and High Tension Underground Cables
Galvanized Iron Wire and Strands

AMERICAN ELECTRICAL WORKS

PHILLIPSDALE, R. I.

New York
165 Broadway

Chicago
112 West Adams St.

Cincinnati
Traction Bldg.

Boston
176 Federal Street

San Francisco
612 Howard Street

Seattle
1002 First Avenue

"Safety" Products
Made and Sold on Honor

"Safety" Power and Lighting Cables
Paper or rubber covered, for any duty

"Safety" Submarine Cables
A thousand feet or a thousand miles

"Safety" Steel Taped Cable
The cable that made conduits unnecessary

"Safety" Switchboard Cables
Better than most others' best

"Safety" Telephone Cables
The recognized American standard

"Safety" Ruby Core Wire
100% better than the New Code demands

"Safety" Flexibles
For those who insist upon the best

"Safety" Jointing Materials
Fully up to the "Safety" standard

POWER and lighting distribution is fundamentally a problem of conductors; and the safety of the system is dependent upon the insulation of those conductors. "Safety" Insulated Wires and Cables carry to their user an assurance of maximum insulation security wherever they are used. This results from the insistence on our part that every foot of "Safety" Wire or Cable shall measure up to the standard its name implies. For we know that safety is the first essential in insulated wires and cables. Therefore, with us—as with all discriminating buyers—price is always secondary to quality. The price asked for "Safety" Products—some of which are here listed—is what you will willingly pay for the safety you buy in "Safety" Insulated Wires and Cables.

SEAMLESS RUBBER SAFETY INSULATIONS

SAFETY INSULATED WIRE & CABLE CO.
114 Liberty St., NEW YORK
CHICAGO BOSTON
SAN FRANCISCO

ATLANTIC

INSULATED WIRES and CABLES

Extra High Grade

High Grade

Commercial Code

Three brands of insulated wire that mark the maximum of quality and service in their respective grades.

Correspondence Solicited.

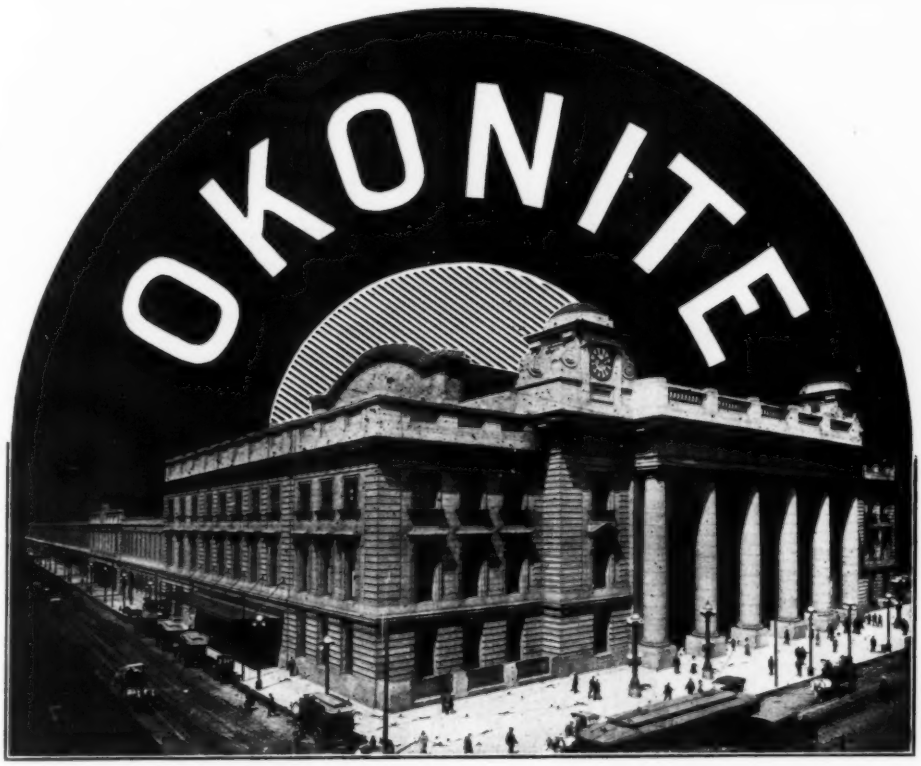
ATLANTIC

INSULATED WIRE AND CABLE COMPANY

SALES OFFICE
120 LIBERTY ST., NEW YORK

FACTORY
STAMFORD, CONN.

2035-0



The Standard for Rubber Insulation.

OKONITE

INSULATED WIRES AND CABLES

were specified in the new terminal of the Chicago and Northwestern Railway Company because the best of material only was used in the construction of Chicago's finest passenger station.

THE OKONITE COMPANY

NEW YORK

Central Electric Company, Chicago—General Western Agents

LOOK FOR THREE BLUE THREADS PARALLEL IN BRAID TRADE MARK REG. U.S. PAT. OFF.

HABIRSHAW
WIRES AND CABLES

used the world over in installations where the best is demanded—used extensively by the world's biggest Central Stations—approved by the biggest engineers in the industry.

"Red Core," "Black Core," "New Code" and Special Wires, Telephone and Telegraph Wires as well as Signal, Submarine, Mine, Torpedo and Underground Cables are embraced in the line of

Habirshaw Wires for All Services

Habirshaw Wire Co.

Offices: Metropolitan Tower, New York
Works: Yonkers, New York

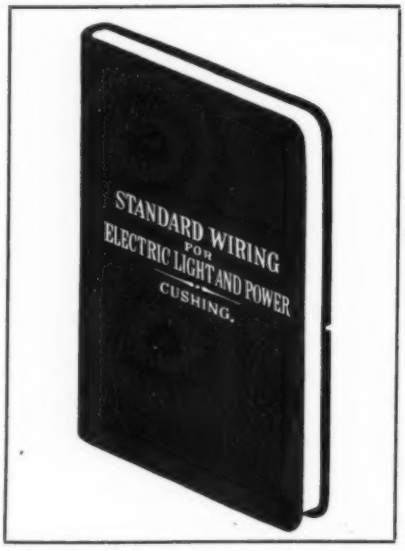
KERITE
When you put your money into KERITE you make an investment in service. You do more than buy conductors, insulation and protection. You obtain the best possible combination of the most desirable qualities in permanent form. KERITE remains long after the price is forgotten
KERITE INSULATED WIRE & CABLE COMPANY
General Offices, 30 Church Street, New York
Western Office, Peoples Gas Building, Chicago

"The Recognized Authority on Wiring and Construction"

—The Electrical Journals of the United States, Canada and England

The 1913 Edition

Completely Revised to Date



What the 1913 Edition Contains

The latest rulings of The National Board of Fire Underwriters, explained and illustrated with line cuts and halftones of the most modern and approved methods.

The latest data on Carbon, Gem, Tantalum, Tungsten and Mazda incandescent lamps.

The most simple and complete formulae and tables, with examples worked out for direct and alternating current wiring for light, heat and power, for all systems — prepared especially for this year's edition of "Standard Wiring" by the greatest electrical engineering company in the world.

Every necessary table for every requirement of the Constructing Engineer, Contractor, Central Station and Wireman.

The most carefully selected list of the "One Hundred Best" manufacturers of officially approved steam and electrical apparatus and supplies in this country, showing everything required for any complete installation.

Adopted

By the Fire Underwriters of the United States.

By Cornell University, Stanford University and other Technical Schools.

By over 240,000 Electrical Engineers, Central Stations and Wiremen.

Because

It is the only book on Wiring and Construction kept strictly up to date.

It contains all the necessary Tables, Rules, Formulas and Illustrations.

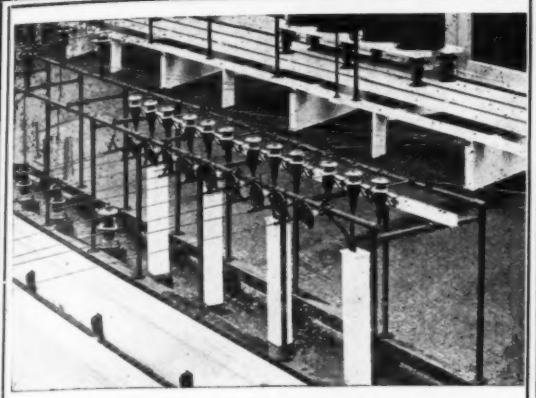
It settles disputes, and if referred to before wiring will prevent disputes.

Flexible Leather Cover (Pocket Size), $1.00. Sent postpaid on receipt of price by

Electrical Review Publishing Co.

Western Headquarters for Electrical Books
Complete Stock of All Electrical Books on Hand

608 South Dearborn St., Chicago



An Interesting Installation of D. O. A. Terminals

The illustration shows how "STANDARD" D. O. A. (Davis Open Air) Cable Terminals are used to effect a convenient and economical entrance of aerial lines through the roof of a power house. Single conductor 15,000-volt terminals are shown with stubs of lead-covered cable attached.

For further information about "Standard" Terminals and other Cable Accessories, call at Booth 38, N. E. L. A. Convention or write our nearest office.

Standard Underground Cable Co.
Pittsburgh, Pa.

New York Philadelphia Chicago
Boston San Francisco St. Louis

For Canada: Standard Underground Cable Co. of Canada, Limited, Hamilton, Ont.

Wm. Wurdack Electric Mfg. Co.

St. Louis, Mo., U. S. A.

Manufacturers of

Panel Boards
Cabinets
Switchboards
Safety Cabinets

Let us figure with you on your requirements

Simplex Caoutchouc (B. C.)

wires and cables are offered to those who wish something better than Code wire.

While the voltage tests on every completed length of Simcore—our 1911 Code wire—exceed the Underwriters' requirements by 33⅓ to 100%, according to size, the corresponding tests on Simplex Caoutchouc (B. C.) which has the same thicknesses of insulation, exceed them by 100 to 185%, as shown below:

VOLTAGE TESTS

SIZE	Required by Underwriters	SIMCORE	SIMPLEX Caoutchouc "B. C."
B. & S. Gage	VOLTS	VOLTS	VOLTS
14 to 8	1,500	2,000	3,000
6 to 2	2,000	3,000	5,000
1 to 4/0	2,500	5,000	8,000
225,000 to 500,000	3,000	6,000	9,000
525,000 and larger	3,500	7,000	10,000

ALL TESTS FOR ONE MINUTE

The tests on the larger sizes of both Simcore and Simplex Caoutchouc (B. C.) have been increased more than on the smaller sizes because the voltage tests of the Underwriters are much more severe on small than on large wires.

These voltage tests not only insure superior quality but are a measure of that quality.

Simplex Wiring Computer on request

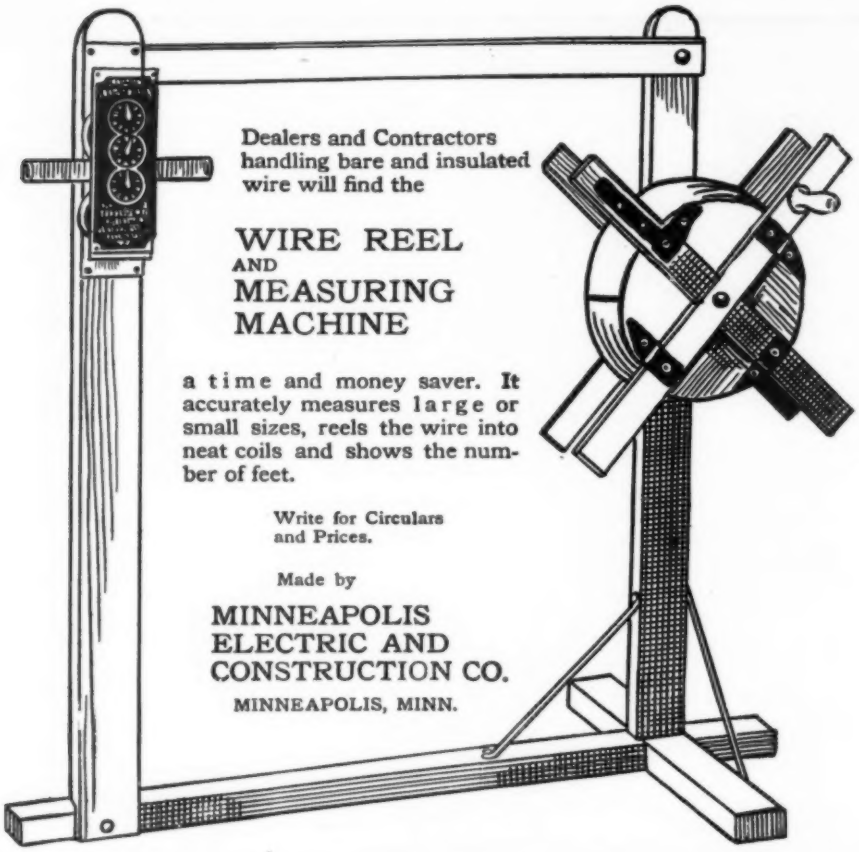
SIMPLEX WIRE & CABLE Co

MANUFACTURERS

201 DEVONSHIRE ST. BOSTON

CHICAGO SAN FRANCISCO

(48-50)



Dealers and Contractors handling bare and insulated wire will find the

WIRE REEL
AND
MEASURING
MACHINE

a time and money saver. It accurately measures large or small sizes, reels the wire into neat coils and shows the number of feet.

Write for Circulars and Prices.

Made by

MINNEAPOLIS ELECTRIC AND CONSTRUCTION CO.

MINNEAPOLIS, MINN.

We Finance
Extensions and Improvements

to Electric Light, Power and Street Railway properties which have established earnings. If prevented from improving or extending your plant because no more bonds can be issued or sold, or for any other reason, correspond with us.

Electric Bond and Share Company

(Paid-up Capital and Surplus $12,000,000)

71 Broadway **New York**

Dealers in Proven Electric Light, Power and Street Railway Bonds and Stocks.

USL
THE UNITED STATES LIGHT AND HEATING CO.

Storage Batteries

are worthy of your consideration. Fourteen years of manufacturing experience enables us to produce a battery that will give you maximum service.

THE U. S. LIGHT & HEATING CO.

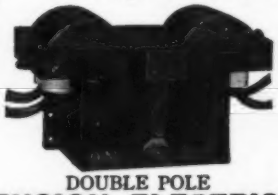
General Offices: 30 CHURCH ST., NEW YORK
Factory: NIAGARA FALLS, N. Y.

Branch Office & Service Stations:
New York, Boston, Buffalo, Cleveland, Detroit, Chicago, St. Louis, San Francisco

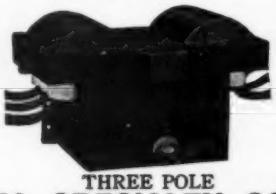
HIGH TENSION WEATHER-PROOF OIL BREAK SWITCHES

For 3000, 4000, 5000 and 6900 Volt System—Capacity 60 to 300 Amperes Single Throw and Double Throw

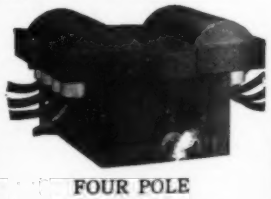
SINGLE POLE



DOUBLE POLE



THREE POLE



FOUR POLE

SEND FOR BULLETIN No. 9

CORRESPONDENCE SOLICITED

HIGH TENSION ELECTRICAL SPECIALTY COMPANY

NEWTON, MASS.

To Members of N. E. L. A.

and All Users of Enclosed Fuses

Type B - N. E. C.

You Get Maximum Protection

when you use "UNION" Enclosed Fuses—why not specify "UNION" on your next order and secure fuses backed by 23 years of experience.

Type A - Old Code

Type C - Old Code

None Better

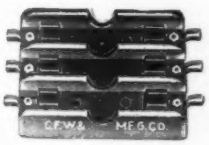
We manufacture every standard type of fuse in all voltages and current capacities met with in practice. Our large stocks permit us to ship *Standard N. E. Code fuses same day as order is received.* Special fuses and old code material made up promptly to your order.

Type E - N. E. C.

The perfect alignment of knife blades in "UNION" Fuses insures good contact and permits easy insertion of fuse into cut-outs—no straining of clips, no heating under normal load, and no excessive potential drop.

Blown Knife Blade Fuses Refilled by Us at Less Than One Half the Cost of New Fuses. Cut-Outs With Perfect Contact Throughout.

Insist on getting goods with our well known trade mark



Porcelain and Slate Cut-Outs

are as perfect as mechanical ingenuity and best materials can produce.

Built on Heavy, substantial bases insuring against breakage.

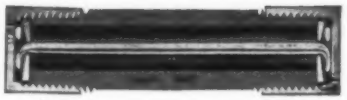
"UNION" Goods Carried in Stock by All the Leading Electrical Supply Houses

Continually Specified by Architects—Preferred by Contractors
Write for New Fuse Catalogue No. 26

CHICAGO FUSE MFG. CO.

1014 W. Congress St., Chicago **1 Hudson St., New York**

Daum Sets the Pace for Renewable Fuses



First successful renewable fuse on the market.

The last

word in fuses.

Fewest parts, most easily assembled, doing away with clamps and threads. Cheapest renewals of any fuse on the market.

If these fuses were not making good, you would not be reading this ad today. Catalogs and samples for the asking.

A. F. DAUM CO., Pittsburgh, Pa.

Representatives:

Willis C. Squire & Co., Western Union Bldg., Chicago, Ill.
Gaskill & Mannion, 17-19 Main St., San Francisco, Cal.

Do You Buy a New Fuse every Time an Old One Blows?

Read this list of representative companies. They save over 80 per cent of the cost of fuse maintenance because they have discarded expensive methods and now have in their service

ECONOMY RENEWABLE FUSES

Anglo-Newfoundland Development Co., Ltd., Grand Falls, Nfld.
Canadian Niagara Power Co., Niagara Falls, Ont.
Cedar Rapids & Iowa City Light Co., Cedar Rapids, Ia.
Central Illinois Public Service Co., Mattoon, Ill.
Central New York Gas & Electric Co., Geneva, N. Y.
Commonwealth Edison Co., Chicago, Ill.
Consolidated Gas & Electric Light & Power Co., Baltimore, Md.
Edison Illuminating Co., Detroit, Mich.
Hudson & Manhattan Ry. Co., New York, N. Y.
Hydro-Electric Power Commission of Ontario, Toronto, Can.
Kaministiquia Power Co., Ltd., Ft. William, Ont.
Lynchburg Traction & Light Co., Lynchburg, Va.
Memphis Consolidated Gas & Electric Co., Memphis, Tenn.
Mobile Light & Railroad Co., Mobile, Ala.
Nashville Railway & Light Co., Nashville, Tenn.
New York State Railways, Rochester, N. Y.
Penn Central Light & Power Co., Altoona, Pa.
Peoria Gas & Electric Co., Peoria, Ill.
Philadelphia Electric Company, Philadelphia, Pa.
Plymouth Electric Light Co., Plymouth, Mass.
Ripon Light & Water Co., Ripon, Wis.
St. Joseph Railway, Light, Heat & Power Co., St. Joseph, Mo.
United Gas Improvement Co., Philadelphia, Pa.
Union Light & Power Co., Franklin, Mass.

These are some of the Light and Power Users. Others include Large Corporations, Industrial Plants, Mining and Smelting Companies, Department Stores, Publishing Companies, Hotels, Office Buildings, Electric and Steam Railroads, Steamships, U. S. Gov't., etc.

Why they use Economy Renewable Fuses:

First, of course, because it provides a practical method of reducing the fuse maintenance expense more than 80%.

Second, because it is the only renewable fuse that is uniformly rated.

Third, because it is the only design so far produced that provides the desired electrical characteristics.

Fourth, because all capacities of renewal elements are readily available, making large fuse stocks unnecessary.

Fifth, because they never vent fire or hold a sustained arc and are absolutely safe.

Sixth, because they meet the performance specifications governing the use of such devices.

Special Announcement!

Two Economy Renewal Elements are now furnished (without charge) with each Economy Fuse. Now YOU figure what fuse is the cheapest not only to buy but also to maintain.

Illustrating the Venting Feature. The cut shows the paths of escaping gases through the openings in the slotted washers, which, in combination with the clearance provided between the various members, form an unobstructed circular and angular path to the open air.

Write for Bulletins, Prices, Discounts, etc., and be sure to see Economy Fuses blow at our N. E. L. A. Convention Exhibit.

ECONOMY FUSE & MFG. CO., Kinzie and Orleans St. CHICAGO

CONNECTICUT'S

MOULDED MICA SOCKETS

For Temporary or Permanent Outside Decorations

These sockets can be furnished separately with or without cap, or ready wired with either No. 12 or No. 14 R. C. stranded wire.

An idea of the different ways they can be connected is shown in the illustrations below. Where it is necessary to furnish temporary decorations, we recommend our No. 26 socket, as they are durable, inexpensive, and a time-saver.

Figs. 1, 2, and 3 show the simple operations installing these sockets with R. C. stranded wire.

For permanent work we recommend our No. 27 socket and cap, soldering the wires to the contacts and filling with cement.

Fig. 1

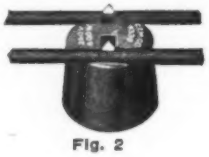
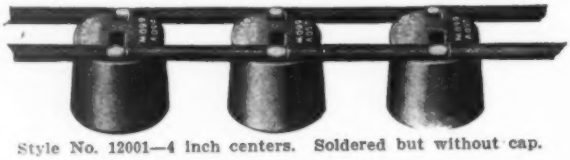


Fig. 2

Fig. 3

Temporary
Style No. 13001—4 inch centers



Style No. 12001—4 inch centers. Soldered but without cap.

Socket and cap complete. Soldered and filled with cement.
Style No. 11001—4 inch centers.

Style No. 26
List Price, Socket only .20
Std. Pkg. 250
For temporary work.

Style No. 27
List Price, socket and cap complete 25
Std. Pkg. 250
For permanent installation.

Style No. 22
List Price ..... .08
Std. Pkg. 100
Porcelain cleat for supporting conductors by guy wire. Double slot porcelain allows hooks to be changed to hang from either direction.

Style No. 23
List Price ..... .10
Std. Pkg. 100
Porcelain cleat for dead-ending line.

Send for Samples and Quotations

CONNECTICUT ELECTRIC MFG. CO.

MANUFACTURERS OF ELECTRICAL SPECIALTIES

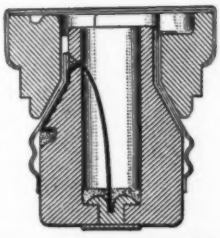
Main Office and Factory:
Connecticut and Florence Avenues
BRIDGEPORT, CONNECTICUT

NEW YORK OFFICE:
50 Church Street

refillable "Fusette Fuse Plugs" List Now at 7c

Mica Cap holder —a permanent investment.

The "Fusette"—a porcelain core containing the fuse strip. This only is wasted when a fuse blows.



Sectional view showing Fusette in holder. Note the good contact of fuse with shell of holder.

The price of our two-piece fuse plug complete has now been made **7c.**

The price of the porcelain core—the fusette—which contains the fuse, is **5c** list.

You save the difference every time a fuse blows—saving 29 per cent.

When a fuse blows take the old Fusette from holder and slip in a new one—only the Fusette is wasted, the holder is as good as ever.

As your present fuse plugs blow out, replace them with Fusette Fuse Plugs. They are "approved," of course, for 125 volt work.

We would like to send you a sample.

H. T. Paiste Co.

PHILA BOSTON NEW YORK CHICAGO

CHELTEN ELECTRICAL SPECIALTIES

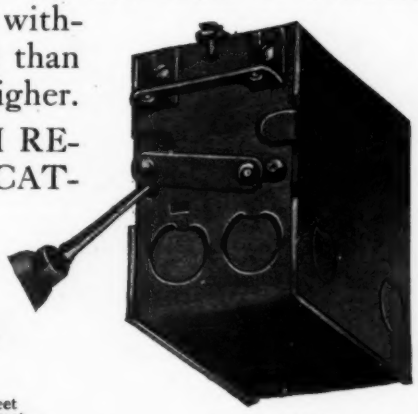
Pat. May 7, 1912

We have just issued a **NEW** 32-page **CATALOGUE,** describing in detail our full line of house wiring electrical specialties. May we send you a copy?

It calls your special attention to our **SHALLOW FLUSH PUSH BUTTON SWITCHES** and our new loom or conduit **WALL BOXES** which can be ganged together without loose screws, in fact—nothing to lose—more than half the time saved in ganging—prices no higher.

We also manufacture a full line of FLUSH RECEPTACLES—GROUND CLAMPS—INDICATING HEATER RECEPTACLES, etc.

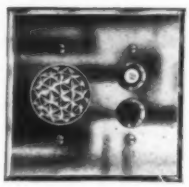
Satisfaction guaranteed — May we quote you?



Pat. Applied For

Chelten Electric Co.—Philadelphia

New York—154 Nassau St.
Cleveland—Citizens Building
Chicago—9 So. Clinton Street
St. Louis—103 No. 11th Street
Vancouver—Mercantile Building
Denver—Empire Building
San Francisco—440 Market St.
Boston—141 Milk Street
Buffalo—1205 Electric Building
Milwaukee—130 Oneida Street
Atlanta—32 Fairlie Street
New Orleans—Box 1609



Bull's Eye
Tell-Tale
Heater Controls

The Bryan
Compa

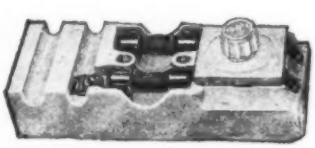
"New Wrinkle" Sockets
"Interchangeable" Porcelain Sockets

Weatherproof Sockets
Outlet Box Receptacles

BRYANT
SUPERIOR WIRING DEVICES
(Reg. U. S. Pat. Off.)

Attachment Plug Receptacles
Switch Rosettes

Cutouts
Fuses



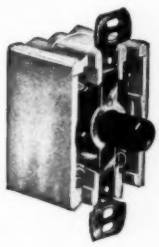
Fuses
Panel Switches

The Bryant Elect

Bridgeport, Co

Chicago

ant-Perkins
panies



Type "O"
Single Button
Push or Pull Switches

Push Button Switches
Snap Switches

Pendant Switches
Knife Switches

PERKINS
SUPERIOR WIRING DEVICES
(Reg. U. S. Pat. Off.)

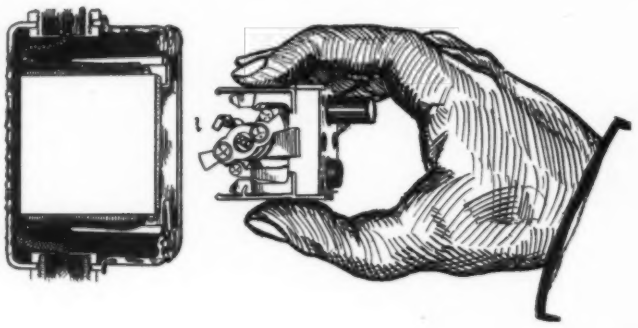
Entrance Switches
Panel Switches

Rosettes
Attachment Plugs

Sockets and Switches
on bases for use with
Metal Moulding

Electric Company
ort, Connecticut

San Francisco



Isn't this simple way 100% easier and better than the old style method of pulling out the switch, disconnecting the wires, reconnecting to a new switch, putting it back in the box and screwing it down? The "Metropolitan" way saves time and labor always.

Metropolitan Detachable Flush Switches

are replacing the fixed types wherever the contractor takes the trouble to investigate the saving he can effect. With the "Metropolitan," the contact box is set and wired at the same time the outlet boxes are put in place. When the building operations are completed, the switch mechanism and face plate are installed, thus absolutely doing away with the breaking of switches due to settling walls, construction accidents, etc. Replacing a switch mechanism entails no other work than removing the face plate, sticking in a new mechanism and replacing the plate. The substantial economy of using Metropolitan Detachable Flush Push Button Switches is apparent to every practical electrician. Wherever you have double pole wiring to your contact box, you can insert a plug and have a flush receptacle, or with another plug you can make a lock switch of the outlet, or with still another plug you can have a combined switch and receptacle outlet.

Write for full information and prices.

METROPOLITAN ELECTRIC MFG CO.

East Avenue and 14th Street
Long Island City, N. Y.

Ask home office or the following:

P. L. Hoadley - 530 First Ave. So., Seattle, Wash.
I. A. Bennett Co. - 565 Van Buren St., Chicago, Ill.
McCleary Harmon Co. - - 423 Stevens Bldg. Detroit, Mich.

Both Trade-Mark and Guarantee

Satisfactory Switch Service

is assured if the switches bear the "Diamond H" of quality. Look for it and insist on it on Push Button, Rotary Flush, Rotary Surface and Automatic Door Switches.

The Hart Mfg. Co.

Hartford, Conn.

New York Boston Chicago
Denver San Francisco
Pittsburgh Toronto, Ont.
London, Eng.

Modern Data on Heating and Ventilating Is Given in

Commercial Engineering for Central Stations

BY ARTHUR WILLIAMS, *Past-President National Electric Light Association,* and EDMUND F. TWEEDY, *Commercial Engineer.*

142 pp., 6x9, illus.; $2.50 (10/6) net, postpaid.

This new work covers the modern question of the greater use of electrical energy in heating, ventilating, refrigerating, etc.

The authors have had a wide experience. They made a special investigation for this work.

The book has many original tables of operating data.

CONTENTS.

I. Coal required to heat a modern city building.
II. Cooling the air of buildings.
III. Cold storage of furs and fabrics.
IV. Mechanical refrigeration and ice-cream making.
V. Cost of generating electrical energy in steam-driven central stations of small and medium size.
VI. Kw-hr. costs in steam-driven generating plants.
VII. Central station load factors.
VIII. Electricity in the modern department store.
IX. The passenger elevator in office building service.
X. Ozone: Its production and utilization.
XI. The use of electricity for the disinfection of sewage.

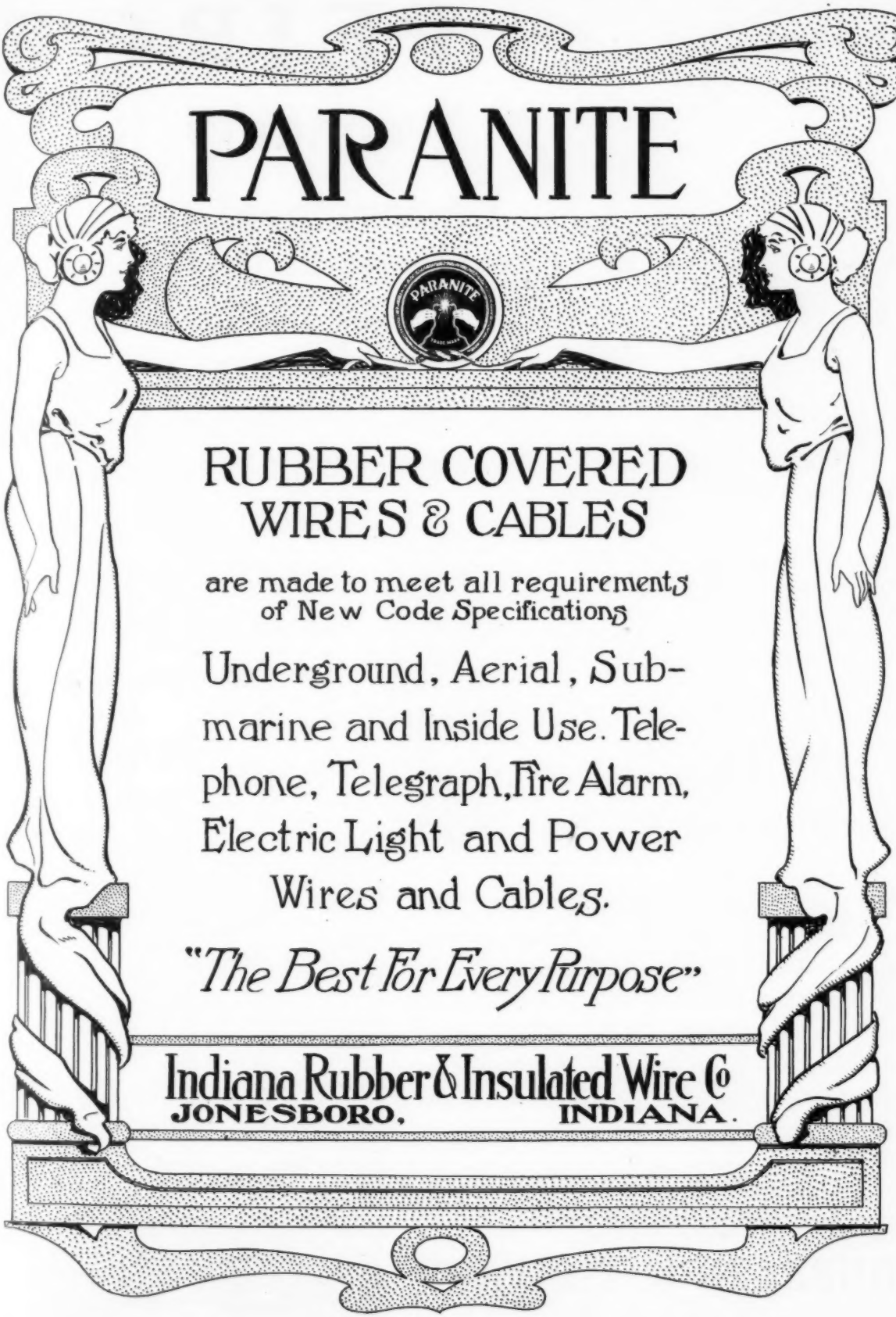
FOR SALE BY

Electrical Review Publishing Co.

Western Headquarters for Electrical Books

608 S. Dearborn St., CHICAGO

PARANITE



RUBBER COVERED WIRES & CABLES

are made to meet all requirements of New Code Specifications

Underground, Aerial, Submarine and Inside Use. Telephone, Telegraph, Fire Alarm, Electric Light and Power Wires and Cables.

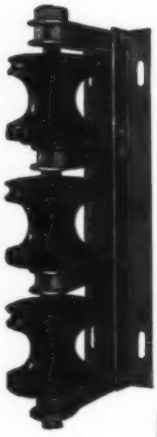
"The Best For Every Purpose"

Indiana Rubber & Insulated Wire Co
JONESBORO, INDIANA.

PEIRCE
Secondary Racks

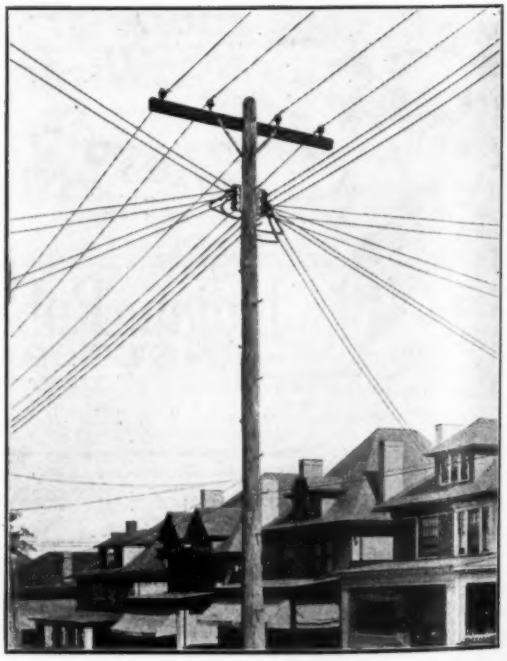
Accomplished the change shown in these pictures. Instead of the unsightly, unsafe eyesore of sagging and uneven wires, the entire system now presents a neat appearance which goes far to counteract the public demand for "all wires underground."

The upper photograph shows a pole with secondary wires strung horizontally and with only four service connections. The lower photograph shows the vertical system made possible by the use of



PEIRCE
Secondary Racks

Seventy-five per cent more service connections can be had; inductive drop is cut down because the wires cannot swing together; uniform sag is maintained; up-keep is reduced as Peirce Racks are made of hot rolled steel, hot galvanized and will last a lifetime; and any time "cut-ins" are required, they can be made quickly and safely and without disturbing existing service wires.



The hardware MAKES the line
Hubbard makes THE hardware

HUBBARD & COMPANY
Pittsburgh, Pa.

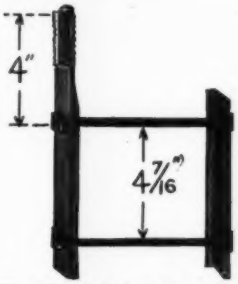
No. 442. One Piece Wide Base Bracket

What Kind of Line Material Do You Want?

Just note the points you consider important:

STRENGTH, RANGE OF SELECTION, LONG SERVICE, Etc.

These and many more features of advantage to you will be found in



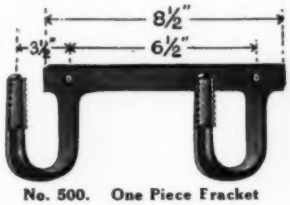
No. 476. Pole Arm, Clamp Pin

No. 250. Fixed Pin Bracket

THE KYLE LINE
MALLEABLE IRON BRACKETS

These can be furnished with insulator tips having felt insertion or without, or provided with the new patented "Hendee" flexible clip.

The "Hendee" clip provides against damage to the insulator through expansion and contraction, or irregularities of the insulator grooves. It holds the insulator firmly at all seasons of the year,—and,—it has the important advantage over other flexible tip brackets in that a **full section of bracket or pin** enters all the way in the insulator. It is the strongest flexible clip made.



No. 500. One Piece Bracket

No. 212. Fixed Pin Break Arm

No. 195. Screw Bracket

Send us your next orders for:

Double Arming or Spacing Bolts
Carriage Bolts
Lag Screws
Guy Clamps
Pole Steps
Guy Rods
Machine Bolts
Cross-Arm Braces
Washers

New Catalog No. 11

for your files, mailed with our compliments. Just send us your name and address

Line Construction Material

READY FOR SHIPMENT FROM STOCK

Galvanized or Plain line hardware as listed in the column to the left, can be shipped from our stock on short notice.

You probably need some of this material now. Get our quotation or send for our new Catalog No. 11, which lists our entire line. We'll gladly forward a copy.

Machine or Through Bolt

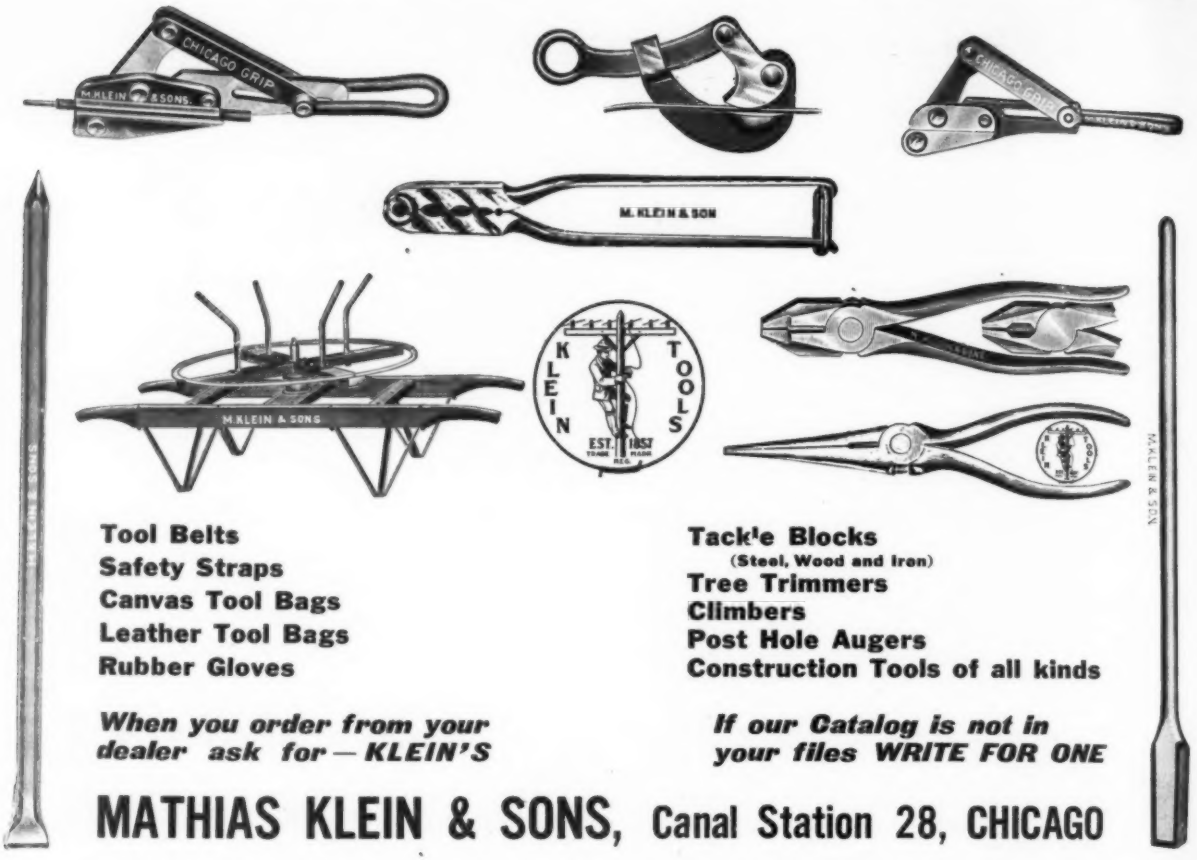
Galvanized Malleable Iron Guy Clamp. Takes ¼" to 7/16" strand

Carriage Bolt

Lag Screw

LINE MATERIAL COMPANY

150-162 Main Street **So. Milwaukee, Wis.**



Tool Belts
Safety Straps
Canvas Tool Bags
Leather Tool Bags
Rubber Gloves

Tackle Blocks
(Steel, Wood and Iron)
Tree Trimmers
Climbers
Post Hole Augers
Construction Tools of all kinds

When you order from your dealer ask for — KLEIN'S

If our Catalog is not in your files WRITE FOR ONE

MATHIAS KLEIN & SONS, Canal Station 28, CHICAGO

"An Instantaneous Success"—Henry Floy's

Valuation of Public Utility Properties

By HENRY FLOY, Consulting Engineer

402 pp., 6x9, with tables and diagrams, $5.00 (21s) net, postpaid

The sale of this book, in its first month, has been exceptionally large. Why? Because it is based on a broad and varied experience. It is definite and practical—not purely theoretical. It is not only the *first* treatise on the subject, but the *most useful*. It gives the exact statements and figures. It will serve as a basis for valuations of all properties not only tangible, but intangible. The engineer who has to undertake valuations—the public official who has to pass upon them—and the executive in charge of the property will all find it of value.

Summary of Contents

I—INTRODUCTION, explaining the purpose of a valuation and basis on which it should be made.

II—GLOSSARY OF TERMS, with explanation of their more general application.

III—PUBLIC SERVICE COMMISSIONS. Reasons for their creation and what is being done by them in the matter of valuations.

IV—MAKING AN APPRAISAL. Information as to the more generally accepted methods of procedure and practical suggestions regarding them.

V—STRUCTURAL COSTS. Discusses methods of making up unit prices, allowances for contractor's profit, engineering contingencies, omissions, etc., with method of valuing real estate, paving and water powers.

VI—DEVELOPMENT EXPENSES, INTANGIBLE EXPENSES. NON-PHYSICAL COSTS, OVERHEAD CHARGES. Discusses approved methods of estimating and allowing for interest, taxes, insurance, legal and organization expenses, cost of financing, working capital, etc.

VII—FRANCHISES, GOOD WILL, GOING VALUE, CONTRACTS. Covers these subjects with the application of principles used in determining these values, quoting at length methods used by the Wisconsin Commission and other authorities.

VIII—DEPRECIATION. Being a discussion based on the paper read by the author before the American Institute of Electrical Engineers.

IX—APPRAISALS OF PUBLIC UTILITY PROPERTIES IN GREATER NEW YORK. Devoted largely to the reproduction of exhibits in important cases before the Public Service Commission of New York City, with discussion by the author of the cases referred to.

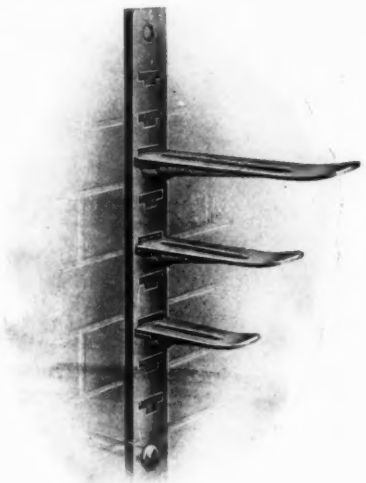
X—IMPORTANT APPRAISALS ELSEWHERE. A reproduction and analysis of figures used in the important appraisals elsewhere, with discussion by the author.

Electrical Review Publishing Co.

Western Headquarters for Electrical Books **608 South Dearborn St., Chicago**

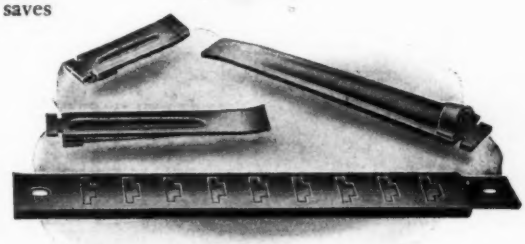
B. & K. Pressed Steel Line Material

will save you money because of low cost, efficiency, durability and labor-saving qualities. Many of the largest consumers of this class of material have adopted the Barnes and Kobert Manufacturing Company's products as standard after long and extensive tests, both mechanically and in service.



B. & K. Guy Clamp will hold beyond the breaking strength of the rope. It is not necessary to take the clamp apart to insert the strand.

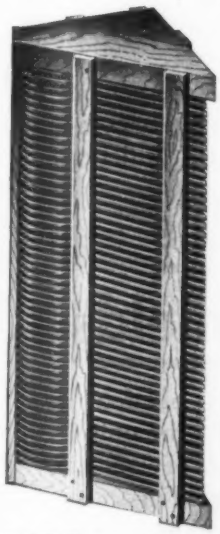
B. & K. Mushroom Guy Anchors are sectional and can be varied to suit all conditions encountered. Compact shipping form saves money.



B. & K. Brackets and Hangers

are superior to all others for these very good reasons:

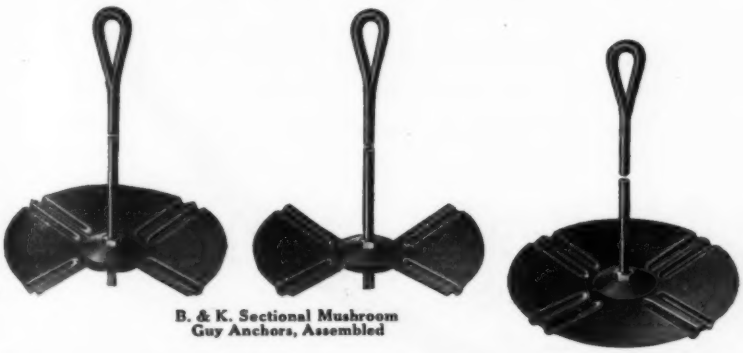
1. Being scientifically proportioned pressed steel every fraction of weight is doing something.
2. The 10-in. Hook will sustain the weight of a 200-lb. man when using the hooks as a means of emerging from a man-hole.
3. The electrically welded heel makes it a one-piece hook.
4. No disturbing of cable in setting up, as a vertical movement of only 5/16 of an inch is required to insert the bracket.
5. Due to the generous bearing surface, the tendency of the lead sheathing to cold flow is eliminated.
6. Having slots pierced in racks 1½ in. to centers gives a great range of positions.
7. Having offset in lower end of rack allows for extending the rack without using additional bolts, making thereby one continuous rack.
8. The entire process of manufacture is one of dies, producing a system of interchangeability that creates uniformity on the job.
9. Due to the enormous production per day of pressed steel articles, we can produce this bracket lower in cost than any other on the market.



B. & K. Standard Guy Clamp

B. & K. Mushroom Anchors Ready for Shipment

B. & K. Sectional Mushroom Guy Anchor, Unassembled



B. & K. Sectional Mushroom Guy Anchors, Assembled

Write Us

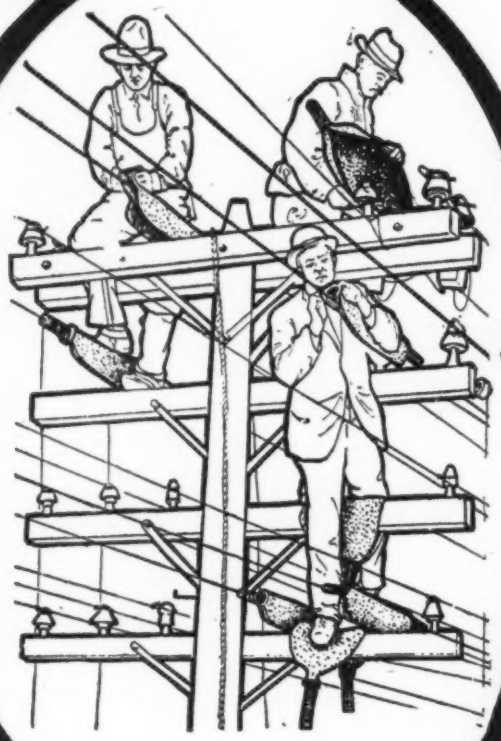
Barnes & Kobert Manufacturing Co.

New Haven, Conn.

Shipments to Western Customers will soon be made from large stocks carried in Chicago Warehouse

Linemen Protector Co.
Whitney Bldg.
Detroit, Mich.

Please send full information regarding Linemen's Shields.



Are Your Crews as Safe as these Men?

Protecting the lives of linemen and the interests of operating companies are the paramount duties of

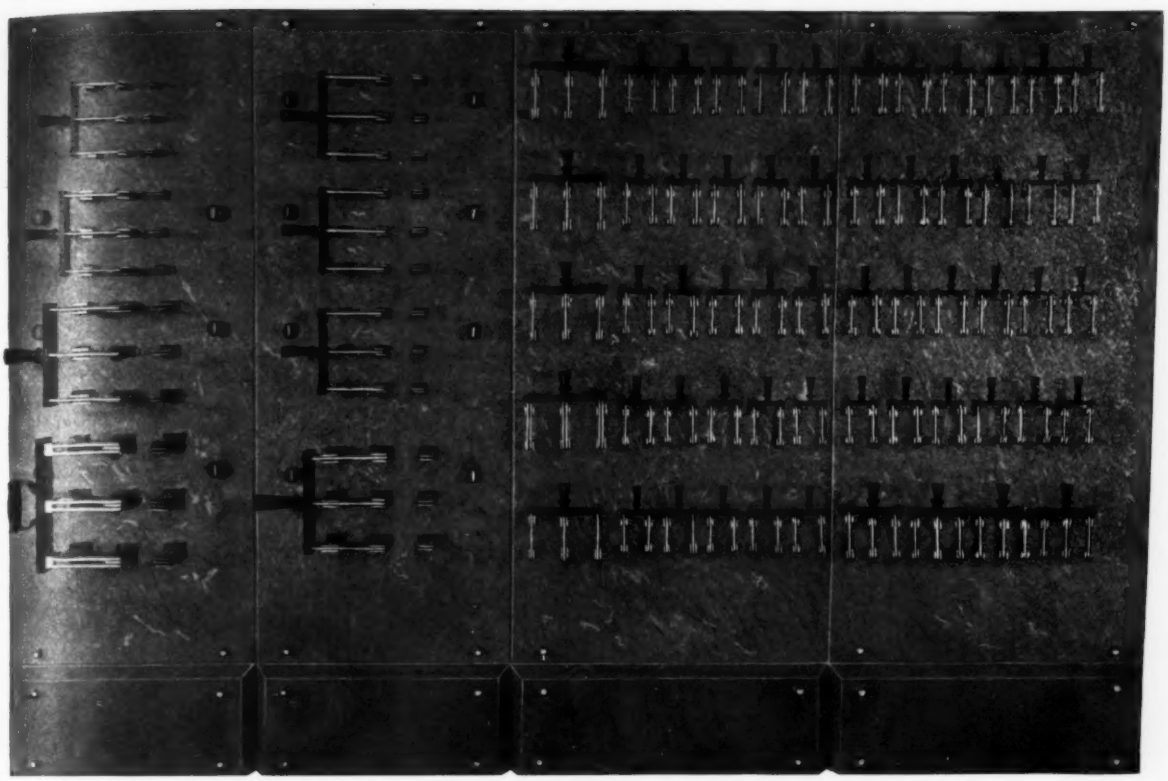
Marshall's Linemen's Shields

The men on the job work in a perfect "zone of safety" if they are guarded against contact with live wires by the only device which fulfills every requirement of protection. All risks of electrocution are eliminated but in addition the sense of security afforded increases working efficiency. Time is saved and annoyance prevented as well as expense avoided by eliminating the necessity of shutting off the current during the progress of line repairs.

The cost of equipping your crews will be less than the expense entailed in defending one damage suit. If 400 progressive companies are convinced that Marshall's Linemen's Shields are a good investment, can you afford to be without their protection?

Use the coupon in the upper corner to obtain full information including list of 400 prominent users, letters of endorsement, etc.

Linemen Protector Co.
Whitney Bldg.
Detroit Mich.



Stage Switchboard, Medinah Temple, Chicago

All Light and Power Distributing Apparatus installed in the Medinah Temple, Chicago, where the 1913 N. E. L. A. Convention will be held, was manufactured by us.

If interested in Switchboards, Panelboards, Steel Cabinets and Stage Apparatus, you should not fail to inspect the installation while at the Convention.

We invite you to call and inspect our factory and secure photographs of the front and back of Medinah Temple switchboard.

See article aescribing this installation in this issue.

ELECTRIC APPARATUS CO.

127-129 South Green Street
(Near Adams Street)

CHICAGO

DE VEAU — AUTOMATIC SWITCHES

OKONITE — TRADE MARK REG. U.S. PAT. OFFICE.

TRADE BROOKFIELD MARK

WAKEFIELD STANDARD UNIVERSAL LIGHTING FIXTURES

DELTABESTON WIRE

BRYANT SUPERIOR WIRING DEVICES

COLUMBIA MAZDA

FWEW WOOD SYSTEMS FORT WAYNE, IND.

1887-1913

FOR Twenty-Six Years

we have aimed to give SERVICE with every order for electrical supplies and apparatus. We are pioneers in the industry, handling the products of Quality manufacturers. The fact that an order for supplies is filled by the House of Service gives double assurance that the electrical material is standard.

OKONITE, for example. During our entire business life we have sold OKONITE Wires and Cables The quality of this Standard for Rubber Insulation has never varied. Made in one grade only.

Central Electric Company,

320-326 South Fifth Avenue

Chicago

OKONITE TRADE MARK

OKONITE TRADE MARK

TRADE Pittsburg MARK

Invincible CLEANERS

CH

MYRLITE

CHICAGO, The Great Central Market, is the logical home for the CENTRAL ELECTRIC COMPANY. All your electrical needs can be supplied by the House of Service. Six stories of equipment and apparatus including such Standard Goods as:

Okonite Wires and Cables
Banner Brand Weatherproof Wire
The Alexalite—Ideal Indirect Lighting System for Offices, Stores or Residences
Columbia Mazda and Carbon Lamps
Diehl Fan Motors—Direct and Alternating Current
Fort Wayne Meters, Motors and Transformers
G. E. and B. & P. Wiring Devices
D & W Fuses
Crouse-Hinds Condulets and Headlights
Central-Pelouze Heating Devices
Wakefield Fixtures
Columbia Dry Batteries
Faraday Bells
Okonite and Manson Tapes
Deltabeston—Asbestos Insulation for Field and Armature Winding
Maxolite—Direct Illuminating Units for Shop, Factory, Garage, Shed and Platform Lighting
Central Lamp Posts for Street, Boulevard and Park Lighting
G. E. Fan Motors—Direct and Alternating Current
Pittsburgh, Hemingray and Brookfield Insulators
Central Type "H" Knife Switches
Klein Tools
De Veau and American Telephones
Invincible and Bee Vacuum Cleaners
Cararra, Gletieco and Opalux Reflectors
Myrlite Cleaner for Glassware
Eveready Flash Lights

Central Electric Company,

320-326 South Fifth Avenue

Chicago

The Convention Report Number

ELECTRICAL REVIEW AND WESTERN ELECTRICIAN
June 7, 1913

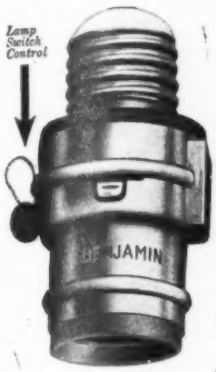
The important papers and discussions and the social and fraternal events that will make the Thirty-sixth Convention of the National Electric Light Association the most notable gathering of electrical men and electrical interests ever held in this country, will be fully reported in the June 7 issue of the Electrical Review and Western Electrician.

This valuable number offers advertisers an opportunity to reach the buying power of the electrical industry by impressive announcements in the Convention Report Number, June 7, 1913. Make reservations for space now. Forms close June 3.

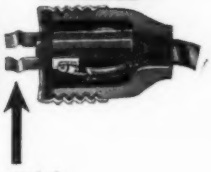
BENJAMIN

"TROUBLE SAVERS"

WILL HELP YOU !



Plug Current Tap



Attached or detached in a second

Attachment Plug

Plug Cluster

That Goods Are Only Half Sold

when they are placed upon the shelves of the Dealer, has been accepted as an axiom in the conduct of our business.

MANY an article with unquestioned commercial possibilities has been abandoned to an untimely fate in the dusty corners of the stock and sales room, because the facilities for featuring its SELLING POINTS—***the points of the finished product which appeal to the user***—have not been given appropriate attention.

We Believe in DEALERS' HELPS

Our reputation for furnishing good goods is of long standing, and unimpeachable. The very name "BENJAMIN" has thus become a selling factor. It creates and carries with it a selling atmosphere. ***But this is merely the starting point.*** The Dealer's goods are our goods, and we are interested in moving them. We promote our interests by promoting his. To assist in the complete realization of this purpose, our SALES PROMOTING SERVICE DEPARTMENT has been established.

You are solicited to take advantage of this service. We have ideas, facts, plans, and literature. Let us tell you about them. Write for a Sample Sales Circular on Benjamin "Trouble Savers."

BENJAMIN ELECTRIC MFG. CO.

120-128 S. Sangamon Street, CHICAGO

NEW YORK: 114 Liberty Street **SAN FRANCISCO: Rialto Building**

Foreign Branches:

THE BENJAMIN ELECTRIC, Ltd.
117 Victoria Street, London, S. W., England

BENJAMIN ELECTRIC MFG. Co. of Canada, Ltd.
11-17 Charlotte Street, Toronto, Ontario

USE OUR *DEALERS' HELPS*

☛Any dealer wishing to increase his sales on Benjamin goods, or having a special sales problem, is invited to address us, care of the Sales Promoting Service Department

INDUSTRIAL LIGHTING

Don't Wait Until Fall

to become active in securing mill, factory, and workshop lighting contracts. The summer season is the logical time to approach the plant owner or manager to show him how proper illumination will assist in speeding up his production when the fall rush sets in. Besides, it is easier for him to revise his lighting equipment just now since the demand for artificial illumination is at its minimum.

NATIONAL QUALITY MAZDA LAMPS

provide the most efficient illumination under all conditions. Not only this, but they give better light—next to daylight, the most pleasant to work by. With National Quality Mazda lamps and Holophane reflectors it is possible to graduate the amount of light according to the area, without waste.

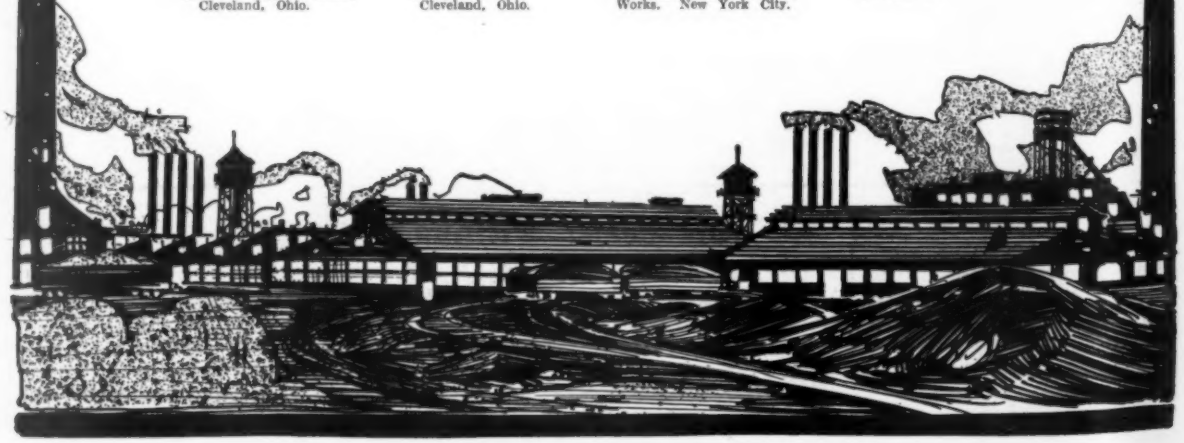
Let our staff of lighting experts co-operate with you. They have at their command almost unlimited data on industrial illumination problems. For specific information address any of the following works of the

NATIONAL QUALITY LAMP DIVISION

OF GENERAL ELECTRIC CO

Cleveland
SIXTH CITY

American Electric Lamp Works, Central Falls, R. I.
Banner Electric Works, Youngstown, Ohio.
Brilliant Electric Works, Cleveland, Ohio.
Bryan Marsh Electric Works, Central Falls, R. I. Chicago, Ill.
The Buckeye Electric Works, Cleveland, Ohio.
Colonial Electric Works, Warren, Ohio.
The Columbia Inc. Lamp Works, St. Louis, Mo.
Economical Electric Lamp Works, New York City.
Elux Miniature Lamp Works, New York City.
Federal Miniature Lamp Works, Chicago, Ill.



SCIENTIFIC STREET LIGHTING

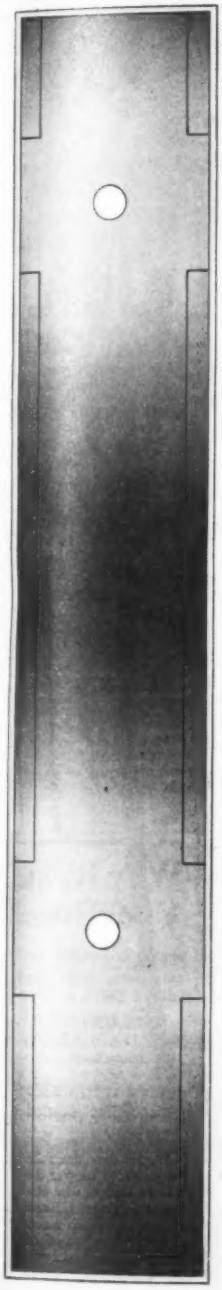


Diagram of street with large units. Note lack of proper distribution. Wasteful and inconvenient.

Why National Quality Mazda Lamps Mean Scientific Street Lighting

Putting a big light on the corner and leaving the middle of the block in darkness is an antequated method of trying to light a street. It gives too much light in some places and not enough in others. It is inefficient in both cost and results.

Proper street lighting requires a continuous line of light—a succession of small units so placed as to cover the entire street area without loss of light toward the sky or in the open air.

NATIONAL QUALITY MAZDA LAMPS

are ideal for this purpose. Made in all sizes, they may be used singly or in clusters. They give three times as much light as carbon lamps at the same cost for electricity. They require no trimming and no attention. They are very rugged. They burn in any position.

Our Street Lighting Service Department is exclusively devoted to the problems of better and more economical street illumination and will furnish complete data, plans, estimates and recommendations without obligation and expense of any kind. For information address any of the member works of the

NATIONAL QUALITY LAMP DIVISION

OF GENERAL ELECTRIC CO

Cleveland
SIXTH CITY

The Fostoria Inc. Lamp Works, Fostoria, Ohio.
General Inc. Lamp Works, Cleveland, Ohio.
Monarch Inc. Lamp Works, Chicago, Ill.
Munder Electric Works, Central Falls, R. I.
Packard Lamp Works, Warren, Ohio.
The Peerless Lamp Works, Warren, Ohio.
Shelby Lamp Works, Shelby, Ohio.
Standard Electric Works, Warren, Ohio.
The Sterling Elec. Lamp Works, Warren, Ohio.
Sunbeam Inc. Lamp Works, Chicago, Ill. New York City.

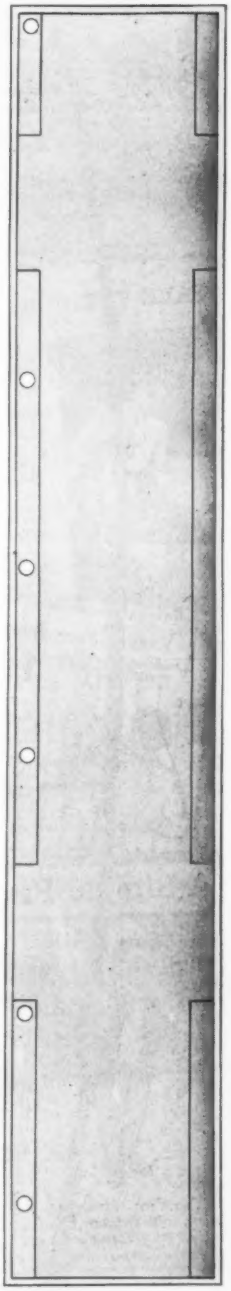
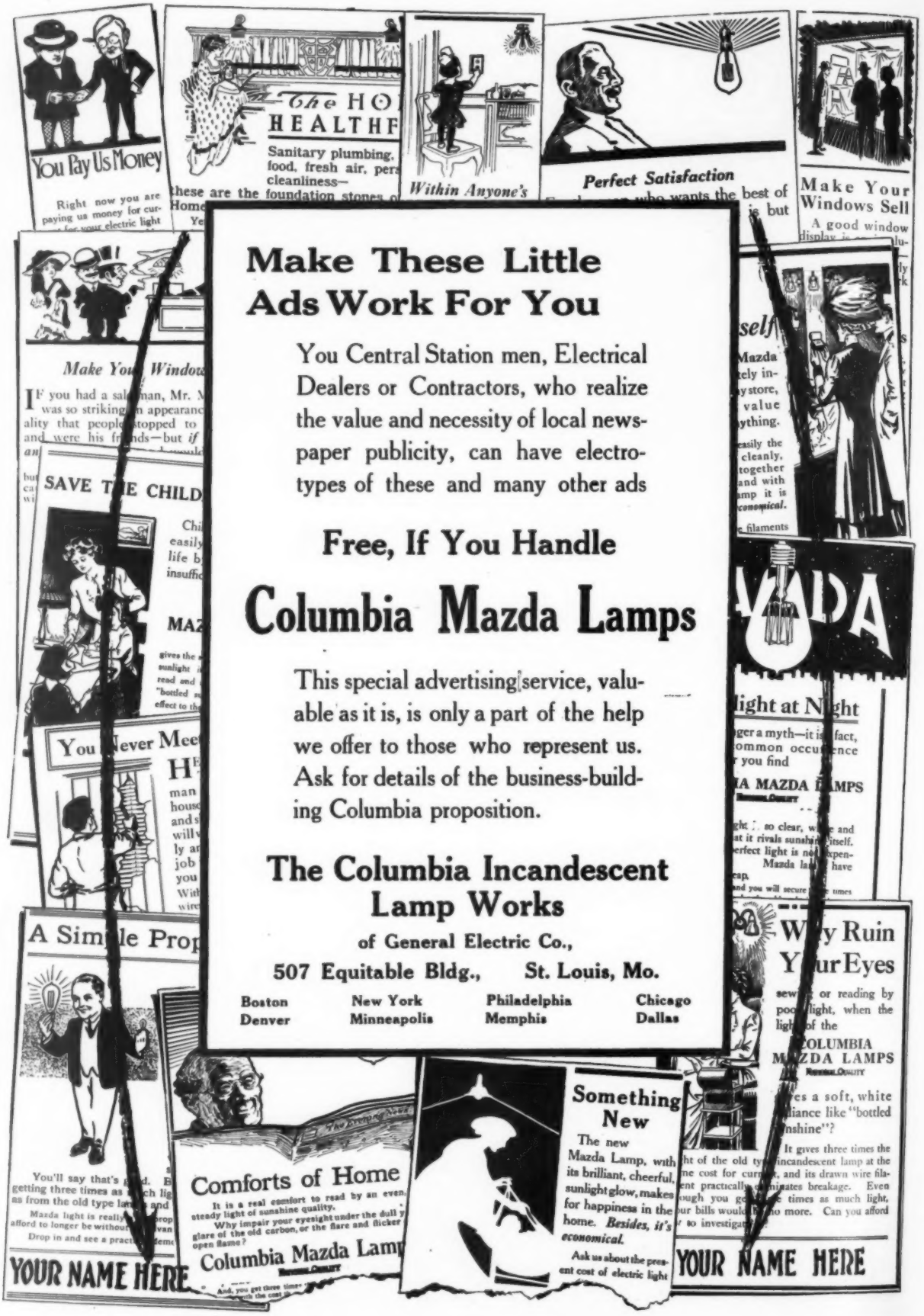
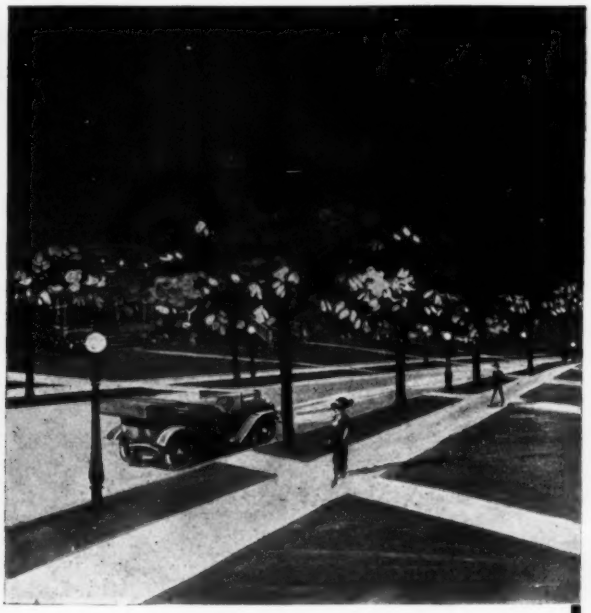


Diagram of street with National Mazda lamps. Costs less to light and gives proper distribution without waste.


You Pay Us Money
Right now you are paying us money for cur-
Within Anyone's
Perfect Satisfaction
Make Your Windows Sell
A good window
Make These Little Ads Work For You
You Central Station men, Electrical Dealers or Contractors, who realize the value and necessity of local newspaper publicity, can have electrotypes of these and many other ads
Free, If You Handle
Columbia Mazda Lamps
This special advertising service, valuable as it is, is only a part of the help we offer to those who represent us. Ask for details of the business-building Columbia proposition.
The Columbia Incandescent Lamp Works
of General Electric Co.,
507 Equitable Bldg., St. Louis, Mo.
Boston New York Philadelphia Chicago
Denver Minneapolis Memphis Dallas
Comforts of Home
Columbia Mazda Lamp
Something New
The new Mazda Lamp, with its brilliant, cheerful, sunlight glow, makes for happiness in the home. Besides, it's economical.
Ask us about the present cost of electric light
YOUR NAME HERE
YOUR NAME HERE



Don't Waste Light on the Tree-Tops

GET the light down to the street, not in spots, but all the way along. Divide up the current used for the corner light and give it to PACKARD Mazda Lamps. Distribute it over the entire block so as to give continuous illumination.

Packard Mazda Lamps

are the highest type of incandescent lamps. They eliminate all labor of trimming and permit a lamp of the right power, either small or large, to be placed wherever it is needed. They put the light beneath the leaves of the trees close enough to the pavement to insure adequate, even, continuous illumination without glare. They are inexpensive to operate and maintain—they give excellent lighting results.

The PACKARD Mazda Street Series lamp provides a unit of high efficiency which may readily and profitably be substituted for other systems of street lighting.

Our street lighting service department specializes on municipal lighting problems and will furnish without obligation or expense any information concerning modern and scientific illumination of streets.

Packard Lamp Works

OF GENERAL ELECTRIC CO

Warren, Ohio

This New Carton Makes It Easy

for the customer to take home five lamps in one package. And if any further proof of the sturdiness of the

Drawn Wire

LUX MFG. CO. N.Y.C. TRADE FLEXILUX MARK

Tungsten Lamp

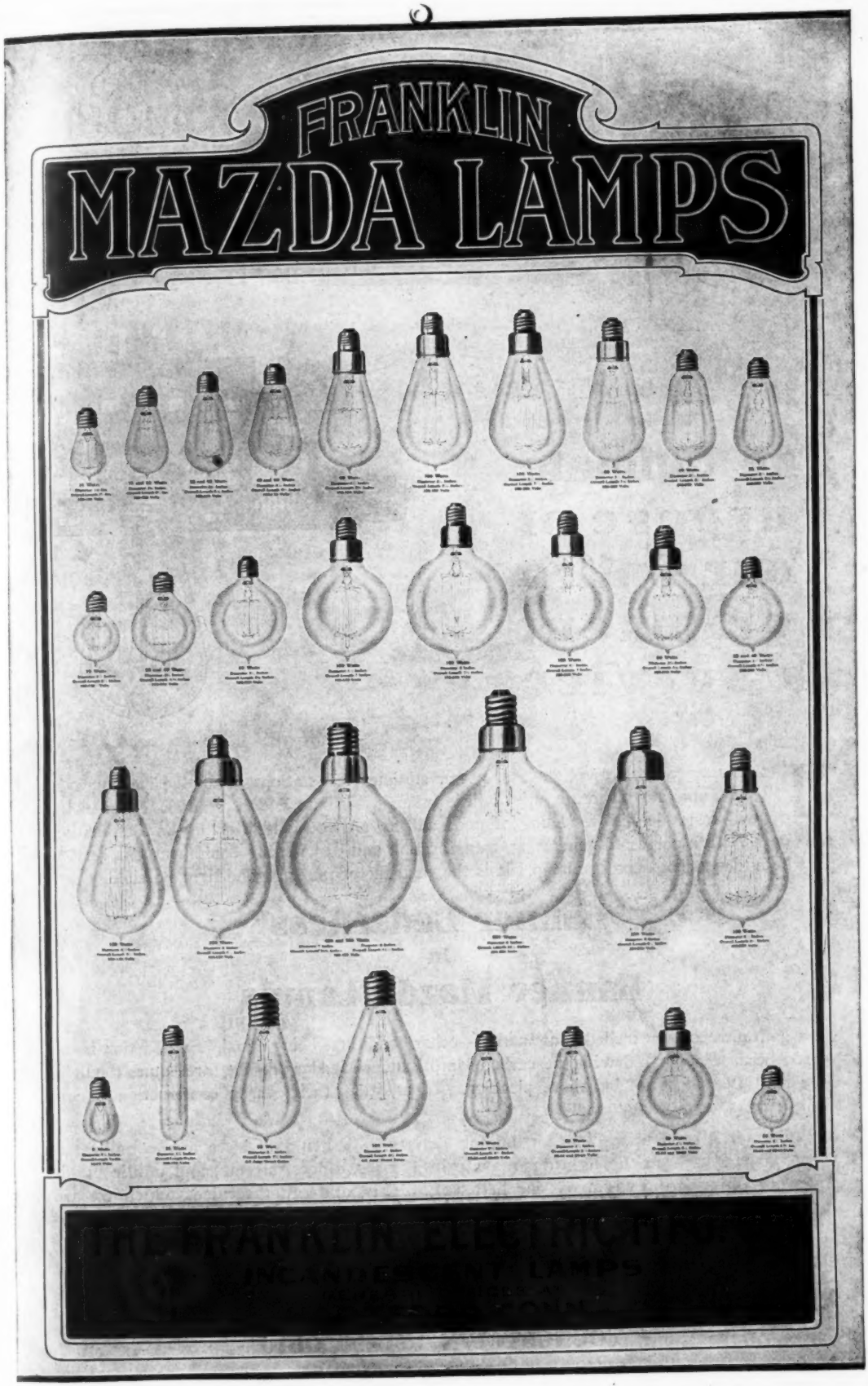
were needed, it is supplied by this method of packing. Do you think, for one minute, that a fragile lamp could successfully be transported and sold in a carton like this?

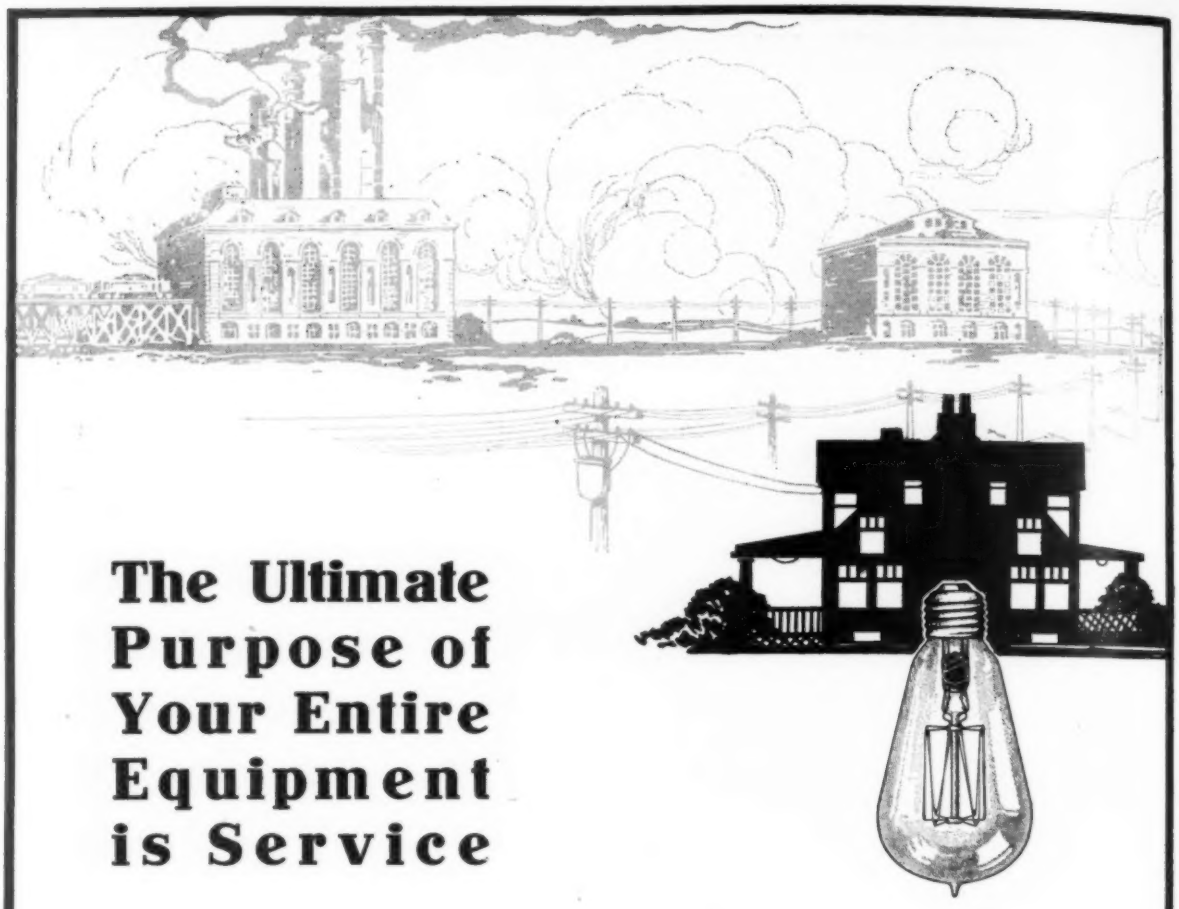
Why not order a trial lot of Flexilux and see for yourself?

Lux Manufacturing Company
50-52-54 Grove Street
NEW YORK CITY

Tel. 2151-2152 Spring

PAINE, BAILEY & CO., 440 Market St., San Francisco, Pacific Coast Agents


FRANKLIN
MAZDA LAMPS



The Ultimate Purpose of Your Entire Equipment is Service

TO the average electric light user power stations, sub-stations, and distributing systems, however elaborate, are of little interest. What he *does* appreciate and what will foster in him a feeling of good-will toward you is high quality in illuminating service. With a perfected generating, transforming and distributing equipment this service is wholly dependent upon the lamp. It is the final factor making good light possible.

"Banner Betterness"
in
Banner Mazda Lamps

is a guarantee of unexcelled illumination—other conditions being equal. Satisfaction is insured because compared with the carbon lamp Banner Mazdas provide three times the light—a light that is noticeably more pleasing. In addition, their sturdy construction practically eliminates breakage troubles.

Banner Mazda lamps imply "Banner Service". When you have any complicated problems to solve in the lighting of factories, stores, offices, streets, and public buildings our illuminating engineers can help you. This, and other services which we are anxious to give, places you under no obligation.

Banner Electric Works
of General Electric Co.
YOUNGSTOWN, - OHIO

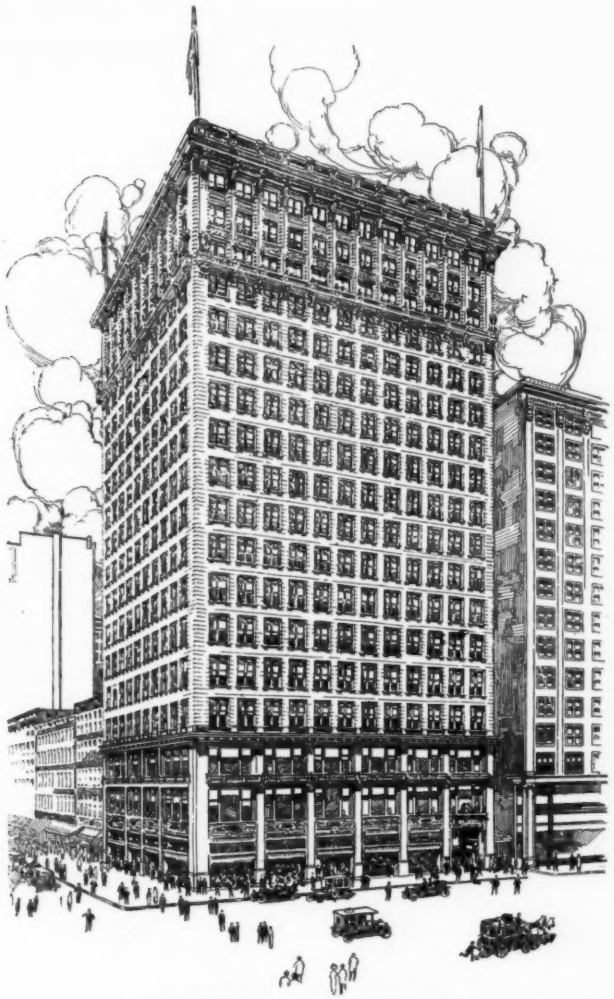
On Your Visit to Chicago

don't fail to see the

Illumination in the Lytton Building

The Handsome
New Home of

"THE HUB"



THE LYTTON BLDG., CHICAGO.
Hub Clothing Co. occupies main floor, basement, two sub-basements and seven other floors. Remaining ten floors are leased for office purposes.

The new Lytton Building, located at State Street and Jackson Boulevard, Chicago, houses the Hub Clothing Company, considered the largest and most beautiful establishment of its kind in the world.

In this remarkable store are many special features of interest, prominent among which is the illumination, which is distinctly new.

The astonishing effect obtained is due in a great measure to the desire on the part of the building owners, Henry C. Lytton & Sons, to install the best possible lighting, and this was accomplished through the assistance rendered by the

Illuminating Engineering Department of the Bryan-Marsh Electric Works

You will be afforded ample opportunity to make an inspection trip through this interesting establishment on your visit to Chicago, the firm of Henry C. Lytton & Sons extending you a cordial invitation to call on them.

In this connection please remember that the services of our Illuminating Engineering Department may always be had without any compensation by all who desire correct and scientifically designed lighting effects.

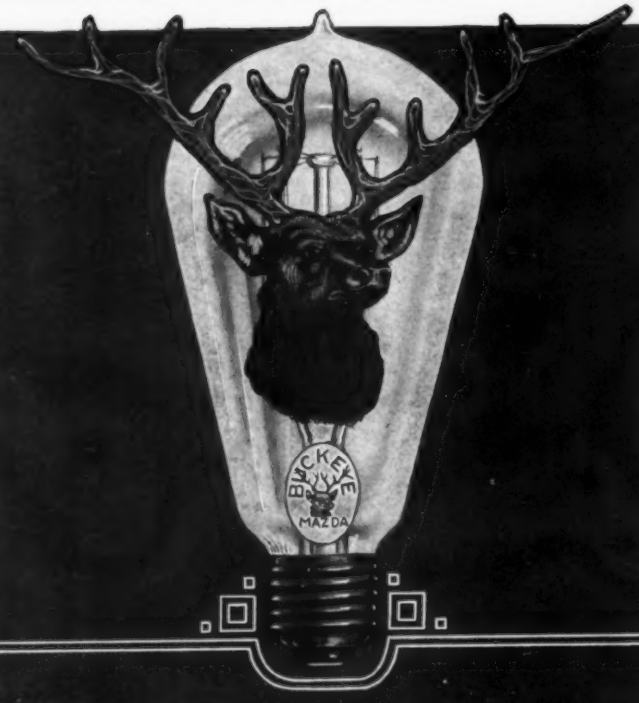
BRYAN-MARSH ELECTRIC WORKS

OF GENERAL ELECTRIC CO.

Central Falls, R. I. **Chicago**

New York Minneapolis St. Louis Kansas City Denver Oakland Detroit New Orleans

The Best Lamp



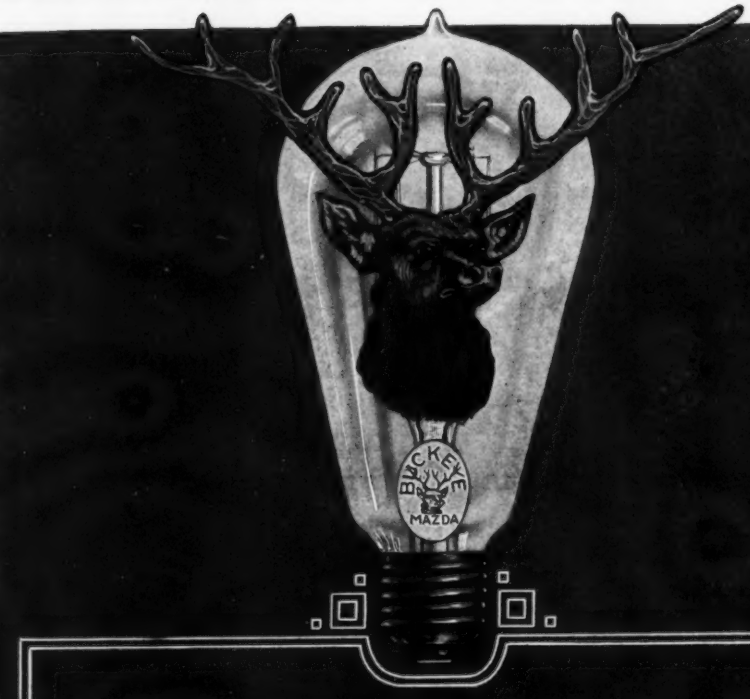
There *is* a difference in lamps—
as those who use Buckeye Lamps know.
Not only are Buckeye Lamps the best
lamps, but they are the BEST KNOWN
Lamps wherever a Buckeye agent
or central station is located.

The Buckeye Electric Works

CLEVELAND

CHICAGO PITTSBURG BOSTON

Best Service



The engineering and business development service rendered by the Buckeye organization to its agents and customers is not only generous—it is SUCCESSFUL. Ask any man who handles Buckeye Lamps.

The Buckeye Electric Works

CLEVELAND

CHICAGO PITTSBURGH

LACO QUALITY

Price, which will compare favorably with any,

Brilliancy, which is a little better than the best,

Endurance, which will pleasantly surprise all users—

Write to us for figures on

LACO LAMPS

Complete stock of all standard sizes and voltages constantly on hand. We back successful estimates by immediate delivery and lamps that more than satisfy.

Current consumption 1.16 w. p. c. for 25-watt
" " 1.14 w. p. c. for 40-watt

"Laco Lamps Last Longest"

Laco Phillips Company

131 Hudson Street
New York City

624 St. Paul Street, Montreal

FRANKLIN MAZDAS

Offering the utmost in lamp values and with every order, personal service and direct attention.

The Franklin Electric Mfg. Co.

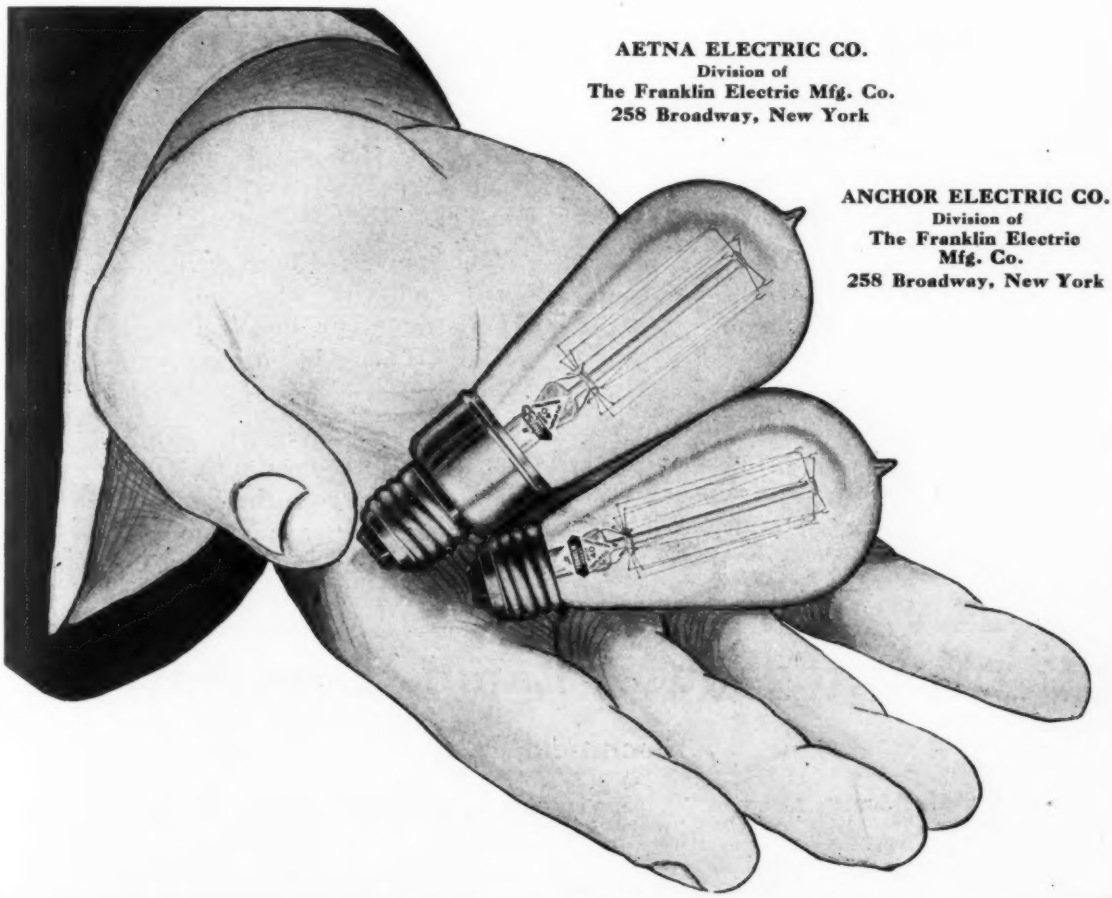
General Offices, Hartford, Conn.

EASTERN ELECTRIC LAMP CO.
Division of
The Franklin Electric Mfg. Co.
Hartford, Conn.

GILMORE ELECTRIC CO.
Division of
The Franklin Electric Mfg. Co.
Hartford, Conn.

AETNA ELECTRIC CO.
Division of
The Franklin Electric Mfg. Co.
258 Broadway, New York

ANCHOR ELECTRIC CO.
Division of
The Franklin Electric Mfg. Co.
258 Broadway, New York



Summer is the Time to Talk House Wiring

Housekeepers would rather have workmen around when it's warm and the doors and windows are open.

With a Westinghouse Mazda lamp to back you up (a name that everybody relies upon and a lamp performance that justifies the name) it's an easy matter to get people interested in the cleanliness, convenience, safety and economy of electric light.

It's just a question of putting it up to people in a forceful manner.

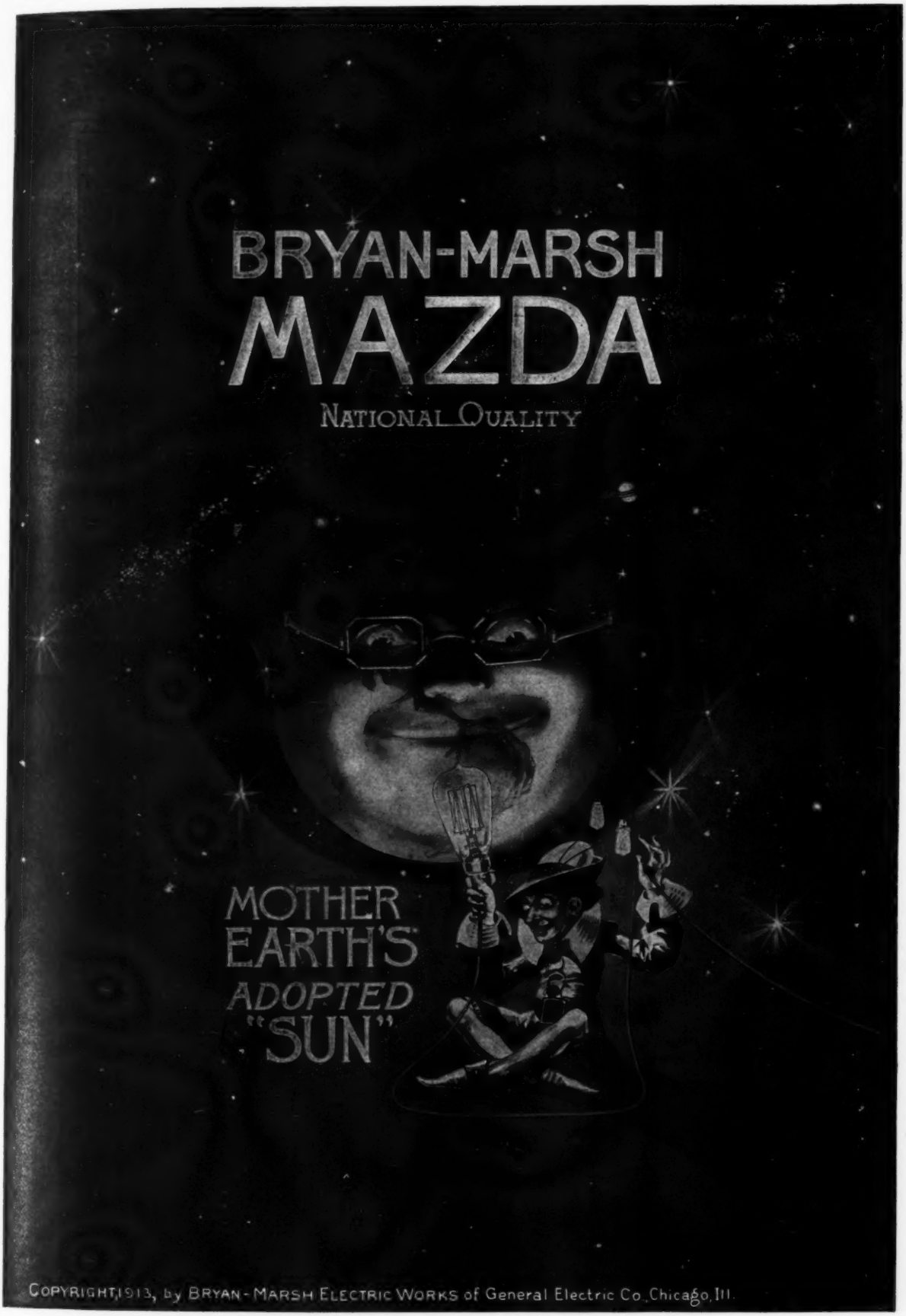
Our "Five Minute Selling Talks" tell you how to do it. They are full of good talking points. They will put new life into your force.

When you have seen them, you will want copies for all of your men to carry in their pockets. Send your name in today to be put on the mailing list.

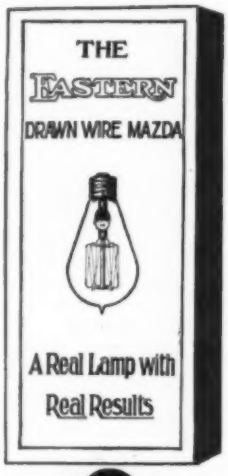
Westinghouse Lamp Company

Bloomfield, N. J.

Offices Throughout the Country. **Factories: Bloomfield, N. J. and New York City.**

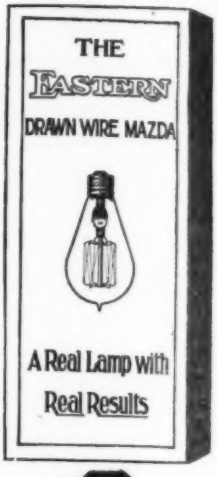

BRYAN-MARSH
MAZDA
NATIONAL QUALITY
MOTHER EARTH'S ADOPTED "SUN"
COPYRIGHT, 1913, by BRYAN-MARSH ELECTRIC WORKS of General Electric Co., Chicago, Ill.

White Light, Life, Durability



The **EASTERN** drawn-wire **MAZDA** lamp exemplifies the most advanced development of the Tungsten filament for electric lighting. It will demonstrate under all conditions that it combines the qualities obtained only by the most scientific methods in the processes of construction and inspection.

Our Label is a Guarantee of Lamp Superiority



EASTERN MAZDA WATTS 40

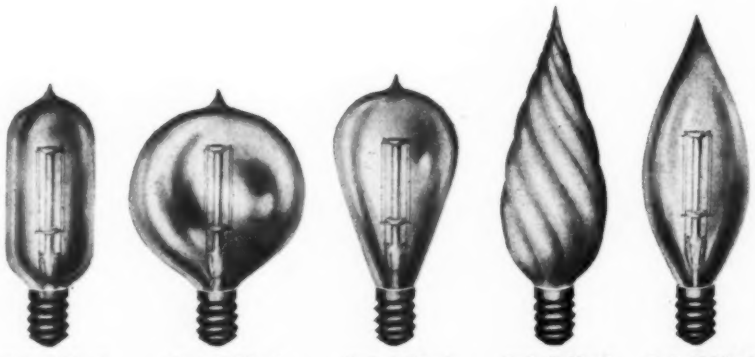
EASTERN ELECTRIC LAMP CO.

DIVISION OF THE FRANKLIN ELECTRIC MFG. CO.

General Offices, Hartford, Conn.

EASTERN MAZDA WATTS 40

47 West Street, New York City, N. Y. 704 Lees Bldg., Chicago, Ill. 31 Milk Street, Boston, Mass. 920 Berger Bldg., Pittsburgh, Pa.
Lippincott Bldg., Philadelphia, Pa. 92 Broadway, Detroit, Mich. 824 State Life Bldg., Indianapolis, Ind.
Pacific Coast Agents: Hughson & Merton, Inc., 530 Golden Gate Avenue, San Francisco, Cal.



Style E Mazda Style G Mazda Style F Mazda Style D Mazda Style B Mazda

Empire Mazda Candelabra Lamps

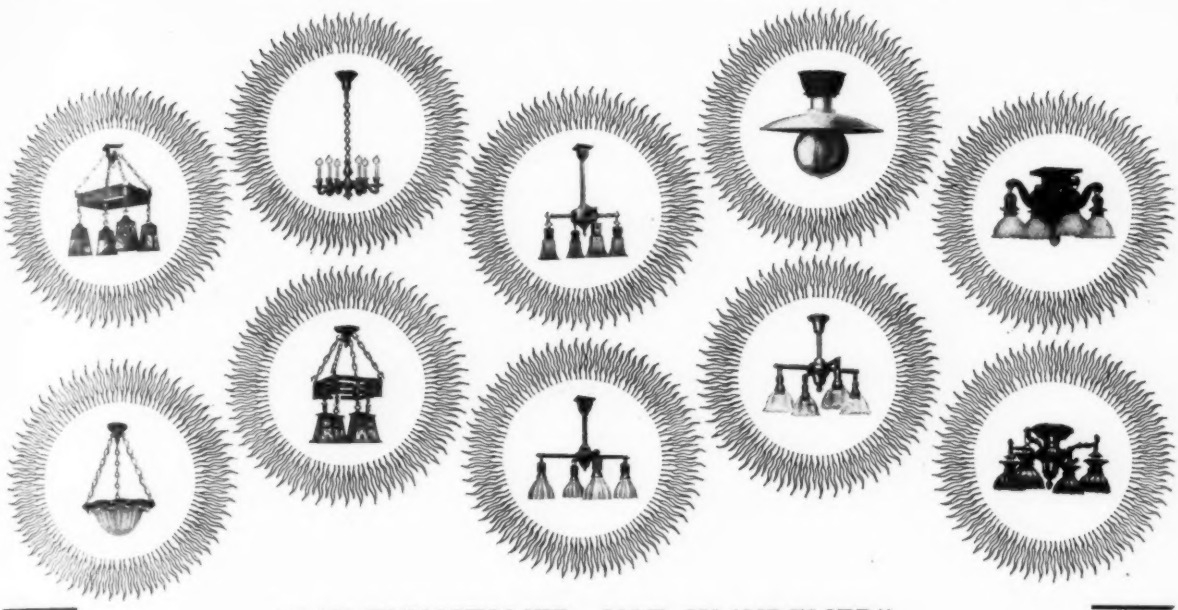
Made with Spiral Coil Drawn Wire Tungsten Filaments
15 Watts, 100 to 130 Volts
The Ideal for Beautiful and Efficient Illumination

Manufactured by

H. W. McCANDLESS & COMPANY

67-69 PARK PLACE NEW YORK CITY

SEND FOR NEW ILLUSTRATED FOLDER No. 31



"SAY TUNGSTOLIER—NOT CHANDELIER"

The Tungstolier Idea

The Highest Quality in the World of Lighting Fixtures

HOW IT HAS GROWN

Originating in a scientifically designed lighting fixture for the Tungsten Lamp, the Tungstolier spirit of improvement has been embodied in ten distinctive lines, providing a Tungstolier for every requirement.

WHAT IT WILL BE

To make Tungstoliers the highest quality of lighting fixtures—to manufacture Tungstoliers in the quickest possible time—to sell Tungstoliers at the fairest price—quality—service—efficiency—are to be the controlling elements in the new Tungstolier factory.

New Tungstolier Factory, Cleveland, Ohio

IN OPERATION JULY FIRST, 1913

with greatly increased capacity and entirely new equipment

Tungstolier Works *of* General Electric Co.

CONNEAUT, OHIO

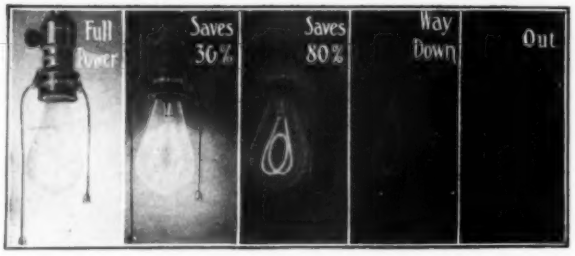
New York Office and Salesroom 105 West 40th Street

(After July First, Address—"1900 Euclid" Building, Cleveland, Ohio)

For Business-Building Ideas—Send for Copy of the Fixtureman

DIM-A-LITE

Dim-a-lite makes any lamp a **"turn down lamp"** and gives five degrees of light from **"full-on"** to **"full-off."** Simply pull the chain.



Full Dim Low Way Down Out

A simple device that any one can attach in a minute. Perfectly suitable for Carbon, Tungsten and Mazda lamps.

The Dim-a-lite will turn down your electric lights **"Just like gas."** We want every dealer in the country to get acquainted with the **Dim-A-Lite,** which is unique, having no competition. A necessity in every electric lighted home. It is not a lamp, but merely a **"vest pocket" Rheostat."**

Fire-proof, fool-proof, and unbreakable. Will last a lifetime. Approved by Underwriters. No stock of supplies is complete without the Dim-a-lite.

Dim-A-Lite

Special introductory offer to the trade

Wirt Electric Specialty Company
Germantown, Phila.

Federal Sign System (Electric), Chicago **Canadian General Electric Co., Ltd., Toronto**
R. Simon-Brunschwig & Co., 7 Rue des Messageries, Paris

Dim-A-Lite and Lamp

KLIEGLIGHT ARC LAMP

Universally recognized as the best light producing apparatus for taking motion pictures.

Universal Electric Stage Lighting Co.

Kliegl Bros.

240 West 50th Street New York
Everything Electrical for Theatres

RECO

Flashers, Time Switches, Lamp Hoods, Sign Board Reflectors.

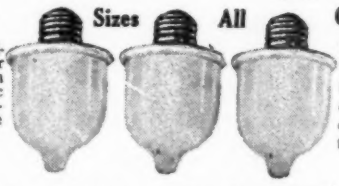
Flashers for Electric Signs—All Types and Styles from 75c Upward.

Cheaper and More Reliable than any Watchman. One-day type. List price $8.00.

Natural Colored Glass Lamp Hoods

All Sizes All Colors

Give beautiful color effects in electric signs or decorative lighting.



More satisfactory than lamp dip and cheaper in the end.

Reynolds Electric Flasher Mfg. Co.

Largest Manufacturers of Flashers in the world, Also Manufacturers of Billboard Reflectors, Colored Lamp Hoods, Time Switches, Window Displays, etc.

Factory and Main Office
617-631 W. Jackson Blvd.
Chicago

New York Office
1123 Broadway,
New York

Phenixlite

The Semi-Indirect Light of the Highest Efficiency

Phenixlite is an improved semi-indirect light with the faults of the previous systems left out.

It is absolutely without glare and gives no direct light from the filament, and produces that much desired **daylight effect,** and—

It does not deteriorate in efficiency from dust. Its use is not limited as to ceiling height or color nor mounting distance from the same.

Its reflecting surfaces are positive in results, and not uncertain, as with the ordinary ceiling.

Phenixlite Assembled
Pat. Applied For

Self contained scientific ceiling.

Reflecting surfaces practically dust proof.

Highly efficient, non-deteriorating.

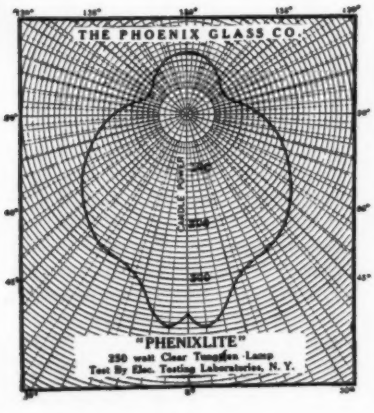
Simple, inexpensive, strong.

Easy to install, clean and get at.

Simple fixture required.

Holder hangs from socket shoulder; no possibility of slipping.

Send today for Phenixlite Booklet.



Parts of Phenixlite
Pat. Applied For

The Phoenix Glass Co.

15 Murray Street **New York**

Manufacturers of "Phoenix Quality" Illuminating Glassware

BOSTON CHICAGO PITTSBURG

An Important Factor In Central Station Industrial Lighting Development

Successful competitor of gas in price.

Easiest and cheapest of all lamps to maintain.

Insures daylight efficiency 24 hours a day.

Cooper Hewitt light has the workman's approval because it is the easiest of all lights on the eyes.

It has the employer's approval because it prevents mistakes and accidents—increases production.

Several of our publications are as good as hand books on industrial illumination for your solicitors. For instance, bulletin No. 3147 entitled "Industrial Lighting." Send for a copy today.

Cooper Hewitt Electric Company

8th and Grand Sts. Hoboken, N. J.

Boston—161 Summer St.
Chicago—180 N. Dearborn St.
Cincinnati—1st Nat'l Bank Bldg.
Cleveland—Engineer's Bldg.
Detroit—Ford Bldg.
Minneapolis—Met. Life Bldg.
Philadelphia—124 S. 8th St.
Pittsburgh—Westinghouse Bldg.
St. Louis—Cen. Nat. Bank Bldg.
Syracuse—University Bldg.

Let Us Help You Save Your Lamps

Patent Pending

Our Policy Is Mazda Lamp Insurance

The reason why E-Z Mazda Lamp Locks prevent theft of lamps and overloading of circuits.

NO KEYS NECESSARY. Too many people have keys, or know how to substitute them.

E-Z MAZDA LAMP LOCKS are easily put on and kept on, and can only be removed by one in authority, having the means to accomplish the trick, with a special tool that is difficult to duplicate. Each tool is numbered and registered by us as to its ownership and location. This prevents these tools getting into hands that will abuse their application.

E-Z Mazda Lamp Locks have been adopted in Theaters, Hotels, Office Buildings, Factories, Mills, Warehouses, Railway Stations, on Railroad Trains and Surface Cars, by Steamship Companies, in Public and private Parks, Hallways, and any and everywhere that Mazda Lamps are used. Central Stations, and Apartment Houses who give flat rates, can protect themselves from loss, by adopting E-Z Mazda Lamp Locks. Locks can be put on and taken off in one-half minute, and it is not necessary to change sockets, or present wiring.

SALES AGENTS

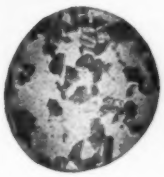
George C. Richards, 629 West Jackson Boulevard, Chicago, Ill.
W. W. Geisse Company, McKnight Building, Minneapolis, Minn.
W. I. Otis, 629 Howard Street - - San Francisco, Cal.
Raymond Ackerman - - - Salt Lake City, Utah

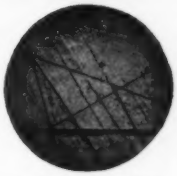
Write for Prices and Discounts

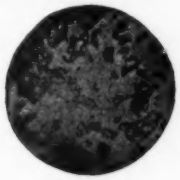
FREDERICK RALL

E-Z Mazda Lamp Locking Devices

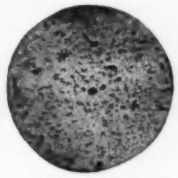
19 Park Place NEW YORK 16 Murray Street


"B" Cleaner


Glass after cleaning with "B"


"C" Cleaner

Glass after cleaning with "C"


"Myrlite" Cleaner

Glass after cleaning with "Myrlite"

Study these micro-photographs. Note the free silicon or similar abrasives in cleaning compounds "B" and "C" and the resulting scratches on glass surfaces following their use. Surfaces so marred are splendid dust and dirt collectors.

Now note the cuts illustrating the constituents of Myrlite and the surface of the glass cleaned with Myrlite.

MYRLITE

gives a crystal finish, absolutely free from an oily or a soapy film, and the most highly polished glass surface is left unmarred by the slightest scratch. Maximum light efficiency at minimum maintenance cost is thus obtained. Rapid cleaning of glassware on the circuit is possible and the ease with which this cleaning is accomplished reduces globe and reflector breakage.

Keep Your Glassware Bright with Myrlite

What Is Myrlite?

Myrlite is a glass cleaning compound with a base consisting of an insoluble neutral carbonate free from silicon, acids, alkalies and soap compounds. It is the result of careful experimentation and research, including actual service tests. Reports of these tests are now being collated and wil soon be published for the benefit of Central Stations and the industry in general.

What Does Myrlite Accomplish?

It cuts the cost of globe and reflector maintenance in two. It reduces lamp, globe and reflector breakage. In street lighting practice, it increases the light from all types of lamps from 15 to 25% It cannot scratch glassware, nor does it, like soapy compounds, leave a dirt collecting film on the surface.

Write for interesting literature and be sure to send for a Free Sample Trimmer's Tube.

The Myrlite Company of America

Pownal Vermont

THE MYRLITE CO. OF AMERICA
POWNAL, VT.
Please send free sample **Trimmer's Tube** to

_____

_____

Lewiston, Maine
Bracket on existing trolley poles without removal of overhead wires.

The Merchants In Your City

are interested in

Ornamental Lighting

and only need your suggestion to start the ball a-rolling.

Start Something

We have the data to send you that will get them interested. Write for it today. New catalog just off the press.

Ornamental Lighting Pole Co.

POLES FOR ALL TYPES OF LIGHTING

122 Liberty Street New York City

New Haven, Conn.
An installation drawing Street Lighting Committees from all over the country.

Meyers Ornamental Standards

will materially help in closing that stubborn contract. Cities in two continents have been beautified by Meyers installations and the U. S. Government is a largeuser of both our Cast Iron and Bronze Standards and Brackets.

Get into touch with us

The Fred J. Meyers Manufacturing Co.
Hamilton, O.

STILL IMPROVING

We are never satisfied because a product is "good enough." We always make it better if we can.

Here is a new feature.

See the Bevel

Silvertip Carbons

will, hereafter, all be beveled opposite the core wire on the holder end. Insert the carbons with this bevel toward the arc.

Night or day trimming easy.

National Carbon Company

CLEVELAND, OHIO

For splendid co-operation in advancing the art of street

lighting, the manufacturers of the Corinthian Standard express thanks and sincere appreciation to the National Electric Light Association.

FLOUR CITY ORNAMENTAL IRON WORKS
Minneapolis Minnesota

THE IMPERIAL

McDonnell Electroliers

BRIGHTER BY NIGHT

ATTRACTIVE BY DAY

The Imperial Electrolier

for Ornamental Street, Park and Boulevard lighting was designated by over five score of progressive cities as the post best suited to carry out the ideals of beauty and efficiency.

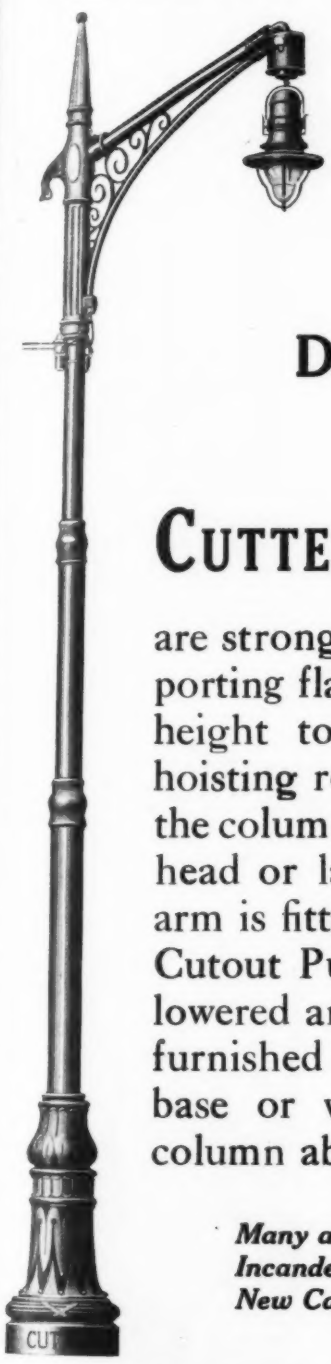
Write us — We will interest you

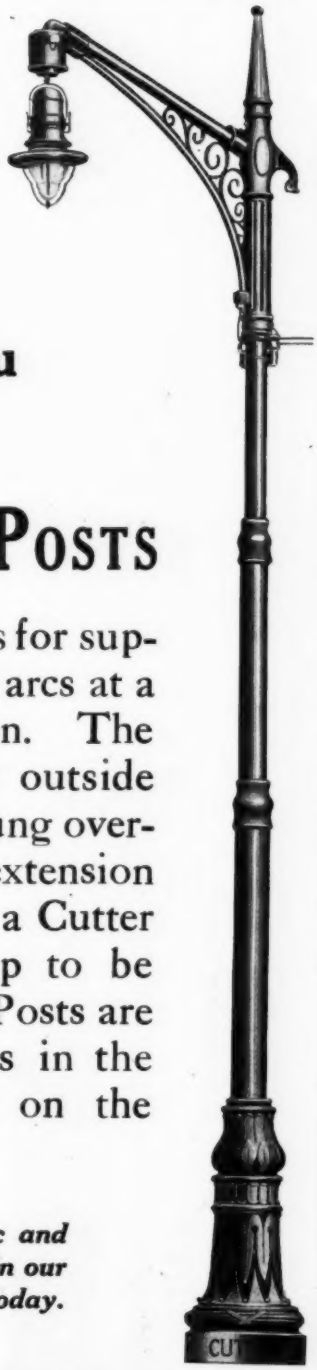
McDonnell Iron Works
Des Moines Iowa

EFFICIENT STREET LIGHTING

with

ARC LAMPS





Depends on How You Hang Them

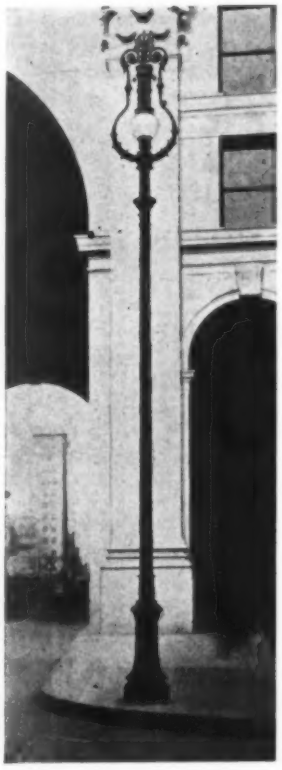
CUTTER FLAMING ARC POSTS

are strong and highly artistic fixtures for supporting flaming arcs and magnetite arcs at a height to give proper illumination. The hoisting rope may be run inside or outside the column and the wires may be strung overhead or laid underground. The extension arm is fitted on the outer end with a Cutter Cutout Pulley which allows the lamp to be lowered and trimmed with safety. Posts are furnished with self-locking windlass in the base or with pole lock mounted on the column above the base.

Many attractive designs of Ornamental Arc and Incandescent Posts and Brackets are shown in our New Catalog No. 12. Write for your copy today.

GEORGE CUTTER COMPANY

407 Notre Dame Street, South Bend, Ind.



Mott Lamp Posts

Examples here shown are of Ornamental Lamp Posts used in lighting New York City by the New York Edison Company. All manufactured by us.

High-grade Lamp Posts for every requirement.

Established 1828.

Specify your requirements and we shall be glad to submit prices and designs.

The J. L. Mott Iron Works

5th Ave. and 17th St., NEW YORK

Hylo Drawn Wire Mazda

Mazda 35 Watts
27 C.P. X 1 C. P.

Is now made and can be supplied in voltages from 100 to 130, and of 35 watts only. The

HYLO MAZDA LAMP

is as rigid and efficient as the ordinary Mazda Lamp.

8 X ½ oat
16 X 1 "
32 X 1 "
all voltages

Standard Hylo

The **HYLO** Mazda and Standard **HYLO** are carried in stock by all electrical supply dealers.

Descriptive literature and prices furnished on application

Economical Electric Lamp Works
of General Electric Co.
25 West Broadway New York

A PROFIT PROPOSITION

That's exactly what handling the

GILL PATENTED TUNGSTEN REFLECTORS

will mean to you—they are so brilliantly beautiful that they don't stay long in the store—("duplicate my order for the ***easy selling*** Crystal Reflectors" writes one dealer). Do you want to be prepared to furnish the best reflectors on the market?

Write now and get our liberal proposition

GILL & CO.
(INC.)

Phila., Pa.

Presenting You The Service

OF — OUR
NEW FACTORY

What You Gain
By Using Beardslee Service

Naturally the thing that interests you most in the new Beardslee factory is how it will help you and your business.

That's why we would like you to visit our new home, when you are at the convention, and see how carefully we have arranged to

Serve You Right

The large clean, well-lighted workrooms; the automatic machinery; the special devices for conveying material from one department to another all go to make the goods right in construction and finish. They are a big factor, too, in giving you a delivery service that other chandelier manufacturers find it impossible to equal.

Come in and look us over when you get in Chicago next week for the Convention. We're two blocks west of the Union Depot and two and one-half blocks south of the new Northwestern Depot. Remember the address, 216-218-220 S. Jefferson St.

Beardslee Chandelier Mfg. Co.
220 S. Jefferson St., Chicago, Ill.

MAXIMUM ILLUMINATION

DURING ENTIRE LIFE OF CARBONS

Are you fully acquainted with the NEW "EXCELLO-DIA" and "EXCELLO"—the expressions of supreme excellence in Flaming Arc Lamp Design?

IF NOT, WHY NOT?

Each month we put it in your power to acquire knowledge of these

Real Lamps

Write us for our new literature, which helps fit you to dispose of more current

The New "Excello-Dia"

100 to 125 hours, for alternating current service, 25 to 133 cycles, two on 110-120 volts, four on 220-240 volts, white or yellow light.

This newest of "Excello" products is of the enclosed vertical "fixed point" type, differentially controlled. The combustion chamber is separated from the lamp proper, and being air tight, the carbons burn under conditions of the least oxygen, and the maximum of illumination is maintained during the entire life of the carbons. The "Excello-Dia" is especially adapted to the lighting of railway stations and yards, wharfs, industrial plants and other large areas.

"Excello"

The old reliable, new model, No. 197. The modern form of the pioneer flaming arc lamp.

The reliable lighting unit of the flame type for lighting large areas, mills, shops, factories, wharves, freight depots, armories, convention halls, ship yards, as well as for display lighting in front of theatres, hotels, restaurants, department stores, etc. Constancy of maximum illumination is maintained during the whole period of burning by the deposit-free globe, while the diverging carbon feed diffuses the light where needed.

KOERTING & MATHIESEN CO.

22 EAST 21st STREET, NEW YORK **630 WEST ADAMS STREET, CHICAGO**

ARC LAMP ILLUMINATION

BASED ON THE USE OF

"ELECTRA," "HEMERA," "EXCELLO"

CARBONS

"ELECTRA" CARBONS—For Enclosed Arc Lamps

The perfect combustion of "ELECTRA" carbons not only reduces cleaning and trimming to a minimum, but insures a maximum of light throughout the life of the carbon. Being accurately straight and uniform in diameter, they do not stick or jump, thus producing a steady light. The performance of any good arc lamp will be materially improved by using "ELECTRA" carbons.

"HEMERA" CARBONS—For Long Life Vertical Flaming Arc Lamps

The future of the long life flame arc lamp depends upon the carbon. "HEMERA" carbons are made to meet the special demands of this type lamp. They burn with an intensely brilliant, steady flame—either yellow or pearl white. Resistance is reduced to a very low point and "HEMERA" carbons burn with minimum ash deposit.

"EXCELLO" CARBONS—For Converging Type Flaming Arc Lamps

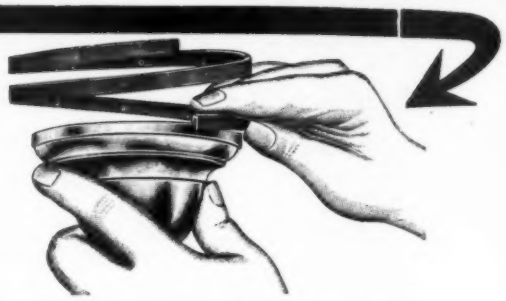
No matter how perfect the construction of a flame arc may be, the quality, intensity and color of light depends wholly upon the carbon used. "EXCELLO" carbons give a pearl-white, brilliant-white, red or yellow light of the same quality throughout the life of the carbon and of the highest candle power for the current used. Current loss is reduced to a minimum by a special patented metal vein.

HUGO REISINGER

11 BROADWAY NEW YORK

E.E.B.
TRADE MARK

CANOPY INSULATORS



We guarantee them to be the most modern, most effective and most convenient canopy insulators made.

They are easily and quickly fastened with a hand punch—no brads or rivets and no danger of grounds.

Proper insulation insured at all times and under all conditions.

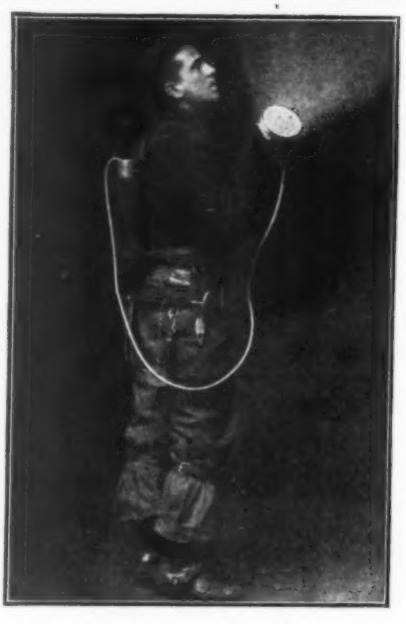
Four inch curles contain 64 inches and are easily adjusted to various sizes of canopies up to 10 inches. Ten inch curles are adjustable up to 20 inches.

Approved by the Underwriters Laboratories.

Write for sample, prices and special discount sheet.

Edmund E. Bechtold

1928 Wabash Ave., Chicago



Your Trouble Department Needs
THE TROUBLEMAN'S PORTABLE SEARCHLIGHT

This outfit is of great assistance at night in the re-fusing of transformers, locating of fallen lines, open circuits, short circuits and the clearing of any line troubles such as stray wires, fallen limbs or broken cross arms.

The main feature of this Searchlight is the protection it affords the troubleman who is called upon to find out and repair the trouble, which is extremely dangerous without sufficient light.

When line troubles or interruptions occur at night, send your man out with a Troubleman's Portable Searchlight and his safety is always assured.

The Troubleman's Portable Searchlight sells at a price conveniently within your means. Write for prices, descriptions and complete information.

The Troubleman's Searchlight gives enough light plainly to distinguish objects at a distance of from seventy-five to a hundred feet.

The Troubleman's Portable Searchlight is a compact piece of apparatus; weighs but 10 pounds.

Visit Our Exhibit at the National Electric Light Association Convention

Electric City Sales Company

Marion, Ind.

Low Operating Costs
Low Maintenance Charges
Increased Revenue

\+

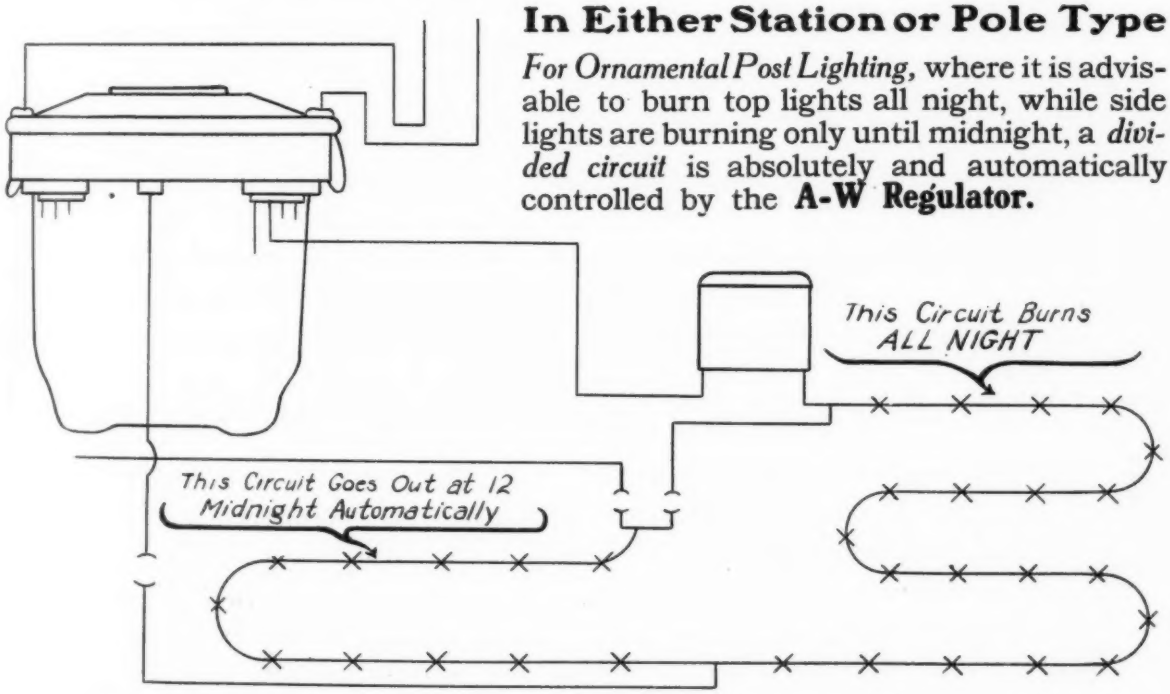
Reliability
Flexibility
Durability

The A-W REGULATOR

is expressly designed to maintain constant current on a Series Mazda Lamp Circuit. No moving parts. Absolute protection against surges and voltage fluctuations. Longer Lamp Life. High efficiency and high power factor at full or part load.

In Either Station or Pole Type

For Ornamental Post Lighting, where it is advisable to burn top lights all night, while side lights are burning only until midnight, a *divided circuit* is absolutely and automatically controlled by the **A-W Regulator.**



For the control of circuits at a distance from the lighting plant ranging from outlying sections of the town to circuits several miles from station, the A. W. Pole Type Regulator in conjunction with our special high potential, oil type time-switch solves the problem.

The lights can be turned on and off at any predetermined time and the necessity of an attendant done away with.

Electric Appliance Company
Chicago New Orleans Dallas San Francisco

Packard Electric Cmpany
Warren, Ohio

Please send full information regarding A-W Regulator

THIS METER CAN BE TAKEN ENTIRELY APART WITH A SCREWDRIVER

You don't need a whole kit of tools when you go out to inspect this meter. All that's needed to take it entirely apart, put it together again or regulate the light and full load adjustment is an ordinary screw-driver.

We have said a lot about the low friction, high ratio of torque to weight of moving element, accuracy of regulation, permanence of calibration, low internal losses, micrometer full and light load adjustments and other good points of the

Fort Wayne Type K_4 Watthour Meter

Now we want to call your attention to its extreme simplicity. Compare its design and construction; its convenience of installation and maintenance with any other on the market. Also consider its durability and unvarying good performance. If there were a probability that it would suffer by such a comparison do you think we would advise you to make it?

Send for Bulletin 1133 and when you have read it you will know why we place such confidence in this grand little meter.

FORT WAYNE ELECTRIC WORKS

OF GENERAL ELECTRIC COMPANY
"WOOD" SYSTEMS
1610 Broadway Fort Wayne, Ind.
Branch Office—All Large Cities

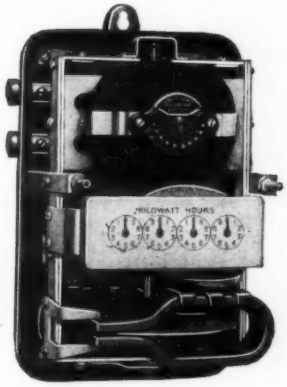
W-18

Reduced Prices

ON DIRECT CURRENT

DUNCAN METERS

Went into effect a few weeks ago (May 1st)



We have been able to reduce the prices on our D. C. Meters through a larger output and the adoption of much automatic machinery. The accuracy and dependability of our instruments have been much improved over older types, and possess every good and lasting quality sought by the up-to-date station manager.

The Duncan Meter, for years, has been recognized as the leader, but our new Model E 1-2 outdoes anything towards perfection heretofore attempted. It is smaller, more compact, and simpler than any of its predecessors. Its ratio of torque to weight is supreme; its pressure and load characteristics are straight lines; and for all kinds of every day service it is decidedly in a class by itself.

Don't fail to see our Model E 1-2 on exhibition at the convention. Get a copy of Bulletin No. 27, and our latest price list.

Duncan Electric Mfg. Co., Lafayette, Indiana

Hoyt A. C. Voltmeter
6 inch size

Hoyt Meters

are the result of a quarter of a century of centralized effort and intelligent application of cumulative experience.

Twenty-five distinct types and sizes enable us to furnish a meter for almost every purpose in commercial electrical measurements.

Hoyt Electrical Instrument Works

Penacook,
N. H.

Loads For Meter Testing Laboratory or Portable

We can furnish loads of any desired current capacity and with any desired power factor. We have a standard line and also build to specifications.

200 Ampere Meter Test Table—Form L-S.

The States Co.

791 Park Street, Hartford, Conn.

Peerless Insulation Tester

THOMPSON-LEVERING COMPANY

PHILADELPHIA, PA., U. S. A.

"Built Like a Watch"

SANGAMO

SINGLE PHASE AND POLYPHASE INDUCTION METERS

You Central Station Managers know that small consumer business is profitable if meter accuracy can be obtained at reasonable cost. IT CAN. Ask any manager who is using the famous

TYPE H INDUCTION METERS

They represent the one real advance in meter-making since the Tesla patents expired. Always accurate, they cut out annoying kicks from customers. High torque, low losses, heavy cover, porcelain dial.

Learn about "The Meter Built Like a Watch" at the N. E. L. A. Convention. We will be glad to talk "Dollars and Cents" from YOUR standpoint.

SANGAMO ELECTRIC COMPANY

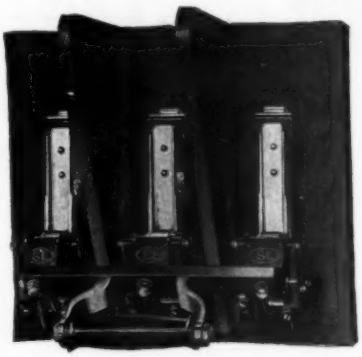
SPRINGFIELD, ILLINOIS

Chicago Office, 617 Jackson Blvd. New York Office, 50 Church St.

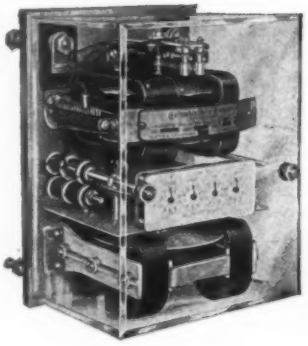
SELLING AGENTS

Electric Appliance Co., Chicago, San Francisco, Dallas, New Orleans
Wesco Supply Co., St. Louis, Fort Worth and Birmingham
Wetmore-Savage Company, Boston Ludwig Hommel & Co., Pittsburg
Rumsey-Electric Co., Philadelphia, Pa. Alfred Collyer & Co., Montreal
Federal Sign System (Electric), Chicago—New York

Dependable Apparatus



Roller-Smith Instruments Meters and Circuit Breakers

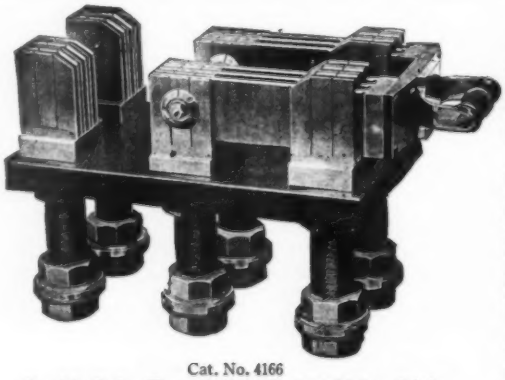


For details apply to

Roller-Smith Company

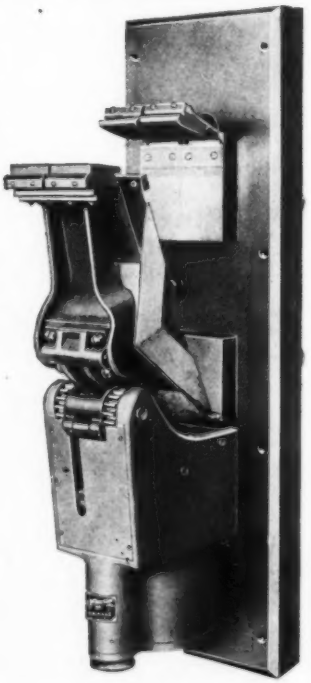
NEW YORK

CHICAGO PITTSBURGH



Cat. No. 4166
Double Pole, Type A Switch, 250 Volts, D. C.

Anderson Switches



incorporate the experience of a manufacturing period of twenty-five years. Nothing but the best materials and the highest grade workmanship enter into the construction of Anderson products. They meet all the requirements of the National Board of Fire Underwriters, are both mechanically and electrically correct in all details and may always be relied upon to carry their full rated load with ample safety margin for overload. Bulletin 23 describes Switches, Switchboard Appliances and Switchboards.

ALBERT & J. M. ANDERSON MFG. CO.

(Established 1877)

289-293 A St., Boston, Mass., U. S. A.

BRANCHES:

NEW YORK, 135 Broadway. CHICAGO, 105 S. Dearborn St.
PHILADELPHIA, 427 Real Estate Trust Bldg.
LONDON, Moorgate Station Chambers

4,000 Ampere Remote Control Switch, 440 Volts, A. C. Solenoid control operates both closing and opening. Current required for operating, 11 amperes at 110 volts, D. C.

Central Stations:—

Protect Your Income

With Fairness to All Consumers
By Using

Maximum Demand Devices

That Are Accurate and Correct in Principle

LOOK THEM OVER AT THE

N. E. L. A. CONVENTION

Chicago, June 2 to 6, inclusive

To Be On Exhibit By

MINERALLAC ELECTRIC COMPANY -	**BOOTH 28**
SANGAMO ELECTRIC COMPANY - -	**BOOTH 51**
WESTINGHOUSE ELECTRIC & MFG. CO.	**BOOTHS 56-9**

Don't fail to visit these booths and see the only accurate maximum demand devices. Based on the modern and correct method. An average demand during a definite time interval.

Chicago Electric Meter Company

Specialists in Maximum Demand Devices

CHICAGO, U. S. A.

THE MOST ECONOMICAL AND EFFICIENT ELECTRIC FURNACES

ARE THE

INDUCTION FURNACES

OF THE KJELLIN, FRICK AND ROECHLING-RODENHAUSER TYPE

AVERAGE TOTAL EFFICIENCY OF THE 10 TON FRICK FURNACES AT THE FAMOUS KRUPP WORKS AS HIGH AS 72%

SIEMENS & HALSKE A. G.

REPRESENTED BY DR. K. G. FRANK

90 WEST STREET, NEW YORK

TRADE OSHKOSH MARK **Construction** Tools and Material

Will be shown at the N. E. L. A. Convention June 2, to June 6, 1913

The Oshkosh Anchor

has 50 per cent greater expansion in virgin soil than any other anchor

It is the result of close study of the defects and limitations of other styles and makes. The Oshkosh is a radical departure from any other anchor now on the market. *We guarantee* this anchor to stand a greater strain than any other of its size, to hold in soils where other anchors fail and to have greater expanded area than any other anchor of corresponding size. One man can set it; guy-wire strain expands it; it is unaffected in efficiency by rocky soil; it exerts "Maximum Resistance with Minimum Digging."

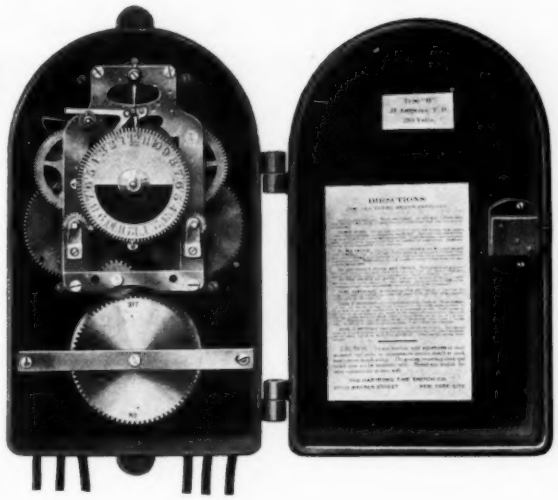
See this new Anchor and the other Oshkosh time, labor and money savers at the Convention, but write for literature NOW

Oshkosh Mfg. Co. **Fox River** **Oshkosh, Wis.**

R. L. Thayer & Co., 424 S. Clinton St., Chicago— *Chicago Distributors*

HARTFORD

THE BEST THERE IS IN



Time Switches

A Hartford Time Switch is made for every service, 10 to 200 amps.

Type B—On and off daily.
Type C—On and off daily, omits Sunday.
Type D—On and off twice daily.
Type E—Two rate meter control.
Type G—Apartment hall light control.

Dust Proof
Weather Proof
Reliable
Efficient
Accurate

Absolutely accurate control of Lighting and Power circuits for any purpose.

They save money and increase window and sign lighting efficiency.

"Just Wind It Once a Week" That's All

Send for New Bulletin

Hartford Time Switch Co.
A. HALL BERRY, Gen. Sales Agent
97 Warren Street, New York, N. Y.

TWO GREAT BOOKS

Hydroelectric Developments and Engineering

A Practical and Theoretical Treatise on the Development, Design, Construction, Equipment and Operation of Hydroelectric Transmission Plants

By FRANK KOESTER

Consulting Engineer, Assoc. Mem. Am. Inst. E. E. Member Society German Engineers (Berlin)

CONTENTS:—Investigation. Forest Preservation. Hydraulics. Economy in Development. Gravity Dams. Movable Dams. Fish-Ways. Head Race. Trenches. Flumes. Tunnels. Syphon System. Racks. Screens. Gates. Collecting Basin. Steel, Wooden and Reinforced Concrete Penstocks. Power Plant Arrangement. Excavation. Foundations. Superstructure. Structural Steel. Turbines. Draft Tubes. Regulating Devices. Oiling Systems. Testing Turbines. Generators. Switching Room. Switchboards. Switchboard Equipment. Wiring Diagrams. Bus Bars. Oil Switches. Relays. Transmission Lines. A. C. Conductors. D. C. Conductors. Strength. Spacing and Size of Conductors. Transposition. Corona Effect. Wooden and Concreted Poles. Reinforced Concrete Poles and Towers. Steel Towers. Economical Spans. Insulators. Wall Outlets. Substations. Transformers. Transformer Connections. Converters. Motor-Generators. Frequency Changers. Switch Gear of Substations. Line Protection. Principle of Horn, Multigap and Fluid Lightning Arresters. Description of Eight Hydroelectric Transmission Plants, viz.: two American, one Mexican, one Norwegian, two German, one Swiss-Italian, and one Austro-Hungarian.

"Mr. Koester has made an exhaustive study of the evolution of the past 15 to 20 years in the great field of hydroelectric development, and has brought his material into compact, sequential form, with the result that we are indebted to him for an exceedingly interesting volume. What constitutes its value in no small degree is the international nature of its data. The reader will find in this handsome, well-written, well-indexed volume the latest ideas, "fads and fancies," and real scientific triumphs of the hydroelectric art."—Electrical World.

Second Edition

8 x 11 inches. 479 Pages. 500 Illustrations. 45 Tables. $5.00 NET

Steam-Electric Power Plants

A Practical Treatise on the Design of Central Light and Power Stations and their Economical Construction and Operation

By FRANK KOESTER

Consulting Engineer, Assoc. Mem. Am. Inst. E. E. Member Society German Engineers (Berlin)

CONTENTS:—Problems, Efficiency and Cost of Plants. Location. General Layout. Coal Storage. Condenser Water Supply. Excavation and Foundations. Steel Work. Architectural Features. Boilers. Mechanical Stokers and Grates. Coal. Combustion. Draught. Smoke Flues. Chimneys. Boiler Feed Water. Feed Water Heater. Superheaters. Superheated Steam. High Pressure Piping. Low Pressure Piping. Prime Movers. Reciprocating Engines. Turbines. Condensers. Pumping Machinery. Oiling System. Electrical Equipment. The Design of Small Light and Power Plants. Testing Power Plants. Descriptive Discussion of Five Typical American and European Light and Power Plants. Principal Dimensions and Data of Recently Constructed Light and Power Plants. Tables per K. W. Capacity. Series of Tables.

"The book represents a lot of diligent work, much research and investigation; it is fully up to the high standard of the author, who has an international reputation in the engineering profession."—Electrical Review, New York.

Second Edition

8 x 11 inches. 473 Pages. 500 Illustrations. 80 Tables. $5.00 NET

Electrical Review Publishing Co.

Western Headquarters for Electrical Books **608 South Dearborn Street, Chicago**

The Ultimate in Snap Switch Design bears the "Circle T" Mark

It took us several years of experimental and research work to perfect a snap switch meeting and conforming to Trumbull Standard. That we have done so is evidenced by the line of snap switches now being made known to the trade under the mark "Circle T."

In Pony, Medium and Large Sizes; Single and Double Pole, Three and Four Point

Single Pole

Cat. No. 300 Pony Size — Cat. No. 312 Medium Size — Cat. No. 322 Large Size

Double Pole — **Three Point**

Cat. No. 342 Medium Size — Cat. No. 352 Large Size — Cat. No. 360 Medium Size — Cat. No. 365 Large Size

Four Point
with cover

"Circle T" Snap Switches are smooth, positive and flexible in action; neat in appearance and have stood all kinds of severe tests. They will stand up with any and better than many on the market.

Four Point
Cat. No. 376

THE TRUMBULL ELECTRIC MANUFACTURING CO.
Plainville, Conn.

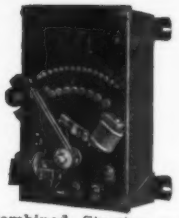
NEW YORK 114 Liberty St. — BOSTON 76-78 Pearl St. — CHICAGO 15 South Desplaines St
PHILADELPHIA 138 North Tenth Street — SAN FRANCISCO 84-88 Second Street

CUTLER-HAMMER

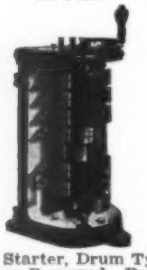
Regulator for Alternating Current Motor. Bulletin 9320.

A. C. Self-starter for single-phase and squirrel cage polyphase motors. Bulletin 9600.

D. C. Speed Regulator for Fans, etc. Bulletin 3110.



Combined Starting and Regulating Rheostat. Bulletin 2240.



A. C. Starter, Drum Type. Cover Removed. Bulletin 9135.

Motor Controllers and Engineering Advice

Motor controllers cannot be sold like packages of breakfast food. Except for the simpler types, they are not a stock proposition. This is the reason that the advice and assistance of our specialized engineering force is of such service to all interested in motor installations of every kind.

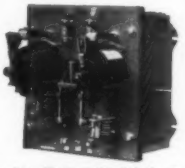
Providing controlling equipment that will give the desired service is usually more than simply selecting the types and capacities of starters or regulators. The characteristics of the motor, the kind of service and individual features of the machinery driven must all be taken into account.

The Cutler-Hammer engineering force is the largest body of men working on motor control problems. Authentic data has been carefully filed during the past 20 years and the experience gained by these specialized engineers cannot be duplicated. When installing motors, it is not necessary that you select the controller. Just put all the facts up to Cutler-Hammer, tell us what result you wish to accomplish and our engineers will give you their recommendations and see your controllers through from the blue print to the finished product.

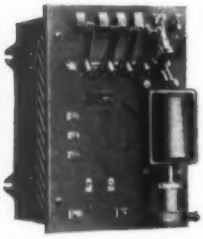
Our catalog of some 1,200 pages describing the many types of controllers is alone enough to indicate the completeness of the Cutler-Hammer line. No matter for what size of motor or for what purpose it is to be used, you can get a Cutler-Hammer controller that will exactly suit your case.

A.C. Starter for Slip Ring Motors of Moderate Capacities. Bulletin 9125.

Enclosed Motor Starter for Dusty Location. Bulletin 2190.



Series Relay Multiple Solenoid Type Automatic Motor Controller. Bulletin 6159.

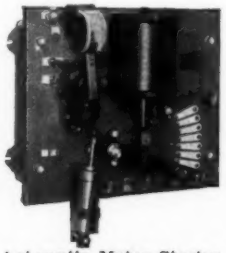


Multiple Finger Automatic Starter. Bulletin 6105.

Bulletin 6095. Automatic starter for small motors.

Machine Tool Controller. Bulletin 5220.

Series Relay Multiple Solenoid Type Controller with main line magnetic switch. Bulletin 6160.



Automatic Motor Starter. Bulletin 6140.

Printing Press Controller. Carpenter Type. Bulletin 4100.

THE CUTLER-HAMMER MFG. CO. MILWAUKEE

NEW YORK: Hudson Terminal 50 Church Street CHICAGO: Peoples Gas Bldg. PITTSBURG: Farmers' Bank Building
BOSTON: Columbian Life Bldg. PHILADELPHIA: 1201 Chestnut Street CLEVELAND: Schofield Building
PACIFIC COAST AGENTS: H. B. Squires Co., 579 Howard St., SAN FRANCISCO, 229 Sherlock Building, PORTLAND, ORE.
and W. B. Palmer, 416 East 3rd St., LOS ANGELES.

Flush Switch.
Cat. No. 7202.

Porcelain Pendent Switch.
Cat. No. 7001.

Attachment Plug with Thermoplax Cap.
Cat. No. 7601.

Brass Shell "Acorn" Pendent Switch.
Cat. No. 7007.

Round Base Surface Switch.
Cat. No. 7107.

CUTLER-HAMMER

PUSH BUTTON SWITCHES
AND SPECIALTIES

A constantly growing line that includes devices having distinctive and radically advantageous features.

C-H Pendent Switches The Standard

Seven distinct types of C-H Pendent Switches are made—to suit every requirement. There are two all-porcelain types—6 amp. and 10 amp. capacity, two porcelain types with threaded brass caps—single pole and three-point; the popular "Acorn" brass shell pendent, the new brass shell two-circuit;—and the porcelain two-circuit pendent. In department stores, offices and other places pendent switches are used for local control of fixtures and lamp clusters.

A Flush Switch Made To Last

The rugged mechanism and heavy terminal lugs and screws eliminate flush switch troubles. In Cutler-Hammer flush switches the contact is made and broken at four points, reducing wear to a minimum.

New Round Base Surface Switch

The absence of protruding operating button is one of the pronounced features that has made the new C-H surface switch so welcome. There is no button to turn the wrong way or lose. The push-bar is part of the mechanism and cannot be removed.

Cord Switch What It's Used For

The C-H polished nickel brass shell cord switch is designed for installation on the cord leading to such heating devices as toasters, table disc stoves, irons, etc. It provides handy control of the current and can be operated with one hand.

Attachment Plugs With Double Lugs

As with other devices, the C-H attachment plug line has radical features, also. Strong double lugs are provided which, while securely locking the cap in place, allow it to be easily released by a side pull. This prevents injurious side strain on fixtures.

The caps of the three styles of attachment plugs are identical and can also be interchanged with the caps of the C-H surface, flush and moulding receptacles.

Attachment Plug Receptacles

provide convenient and safe means for connecting electric heating and other portable electric devices to the circuits. The porcelain and composition caps used with receptacles are the same as those used with C-H plugs and are, therefore, interchangeable.

THE CUTLER-HAMMER MFG. CO., Milwaukee, Wis.

NEW YORK: Hudson Terminal, 50 Church St. CHICAGO: Peoples Gas Bldg. PITTSBURGH Farmers' Bank Bldg.
BOSTON: Columbian Life Bldg. PHILADELPHIA: 1201 Chestnut Street CLEVELAND: Schofield Building.
PACIFIC COAST AGENTS: H. B. Squires Co., 579 Howard St., SAN FRANCISCO
229 Sherlock Building PORTLAND, ORE., and W. B. Palmer, 416 E. 3rd St., LOS ANGELES

Packard

TRANSFORMERS

have a long and honorable record for staying "on the job."

Many Packard Transformers have rounded out a quarter-century of service, and are still doing efficient work.

Packard losses are ***low***—because the quality of Packard construction is ***high*** — all Packard Transformers have silicon steel cores, and are vacuum-dried and impregnated with an absolutely oil-proof compound.

Packard Transformers are sold on a decidedly favorable free trial basis and a yearly contract proposition.

THE PACKARD ELECTRIC CO., 315 Dana Ave., WARREN, O.

Special Western Agents, **Electric Appliance Co.**, Chicago, Dallas, San Francisco, New Orleans

PATENTS! PATENTS!

Save money and time by sending your matters to me.
TRADEMARKS DESIGNS COPYRIGHTS

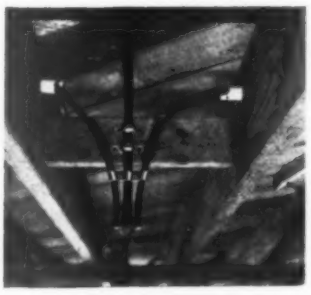
E. S. DUVALL
LOAN AND TRUST BUILDING
WASHINGTON, D. C.

Subscribe for the
INVENTIVE AGE
ONE DOLLAR A YEAR
Contains index of all patents issued each week, and other useful information. Address
INVENTIVE AGE PUBLISHING COMPANY
National Union Building. Washington, D. C.

Secure your Flexible Tubing against Carelessness, Unsightliness, Theft and Fire due to broken insulation

The T.-W. Manufacturing Company Flexible Tubing Clamps

The only device of this kind included in the list of Approved Electrical Fittings issued by the National Board of Fire Underwriters.

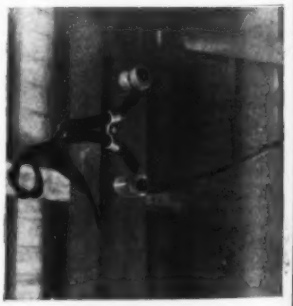


Type " A" Clamp

These new clamps, punched from strap steel having rounded edges to eliminate all danger of cutting the tubing, meet the well-known "long-felt want," because they absolutely guard against careless workmanship, theft and ruined insulation. Nails and staples to hold loom in place should be a thing of the past, now that The T.-W. Mfg. Co. Flexible Tubing Clamps are available.

Type "A" is for use at a combination gas and electric outlet and is provided with three openings, the center one engages the gas pipe and the two outside openings hold the tubing.

Type "B" Clamps are for the use at all straight electric outlets, in knob and tube wiring. Will fit all sizes of canopies and switches.

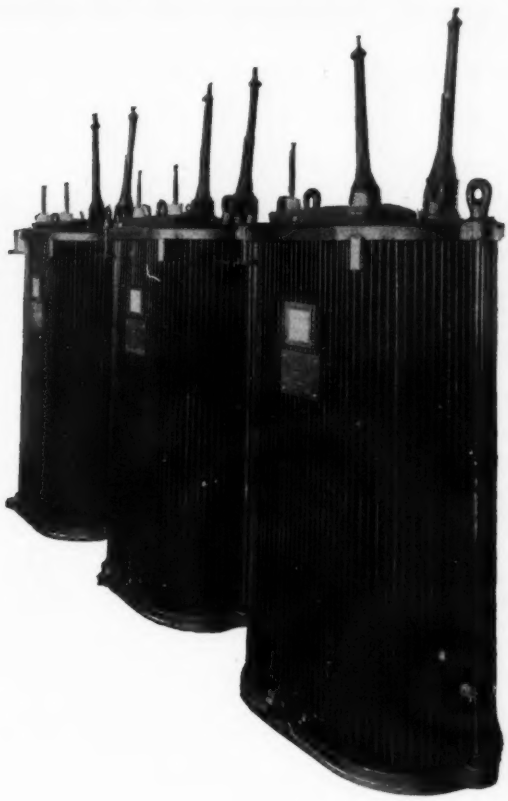


Type "B" Clamp

For discounts and prices write to

The T.-W. Manufacturing Company

Successors to the NEW PROCESS SPECIALTY COMPANY, 713 Majestic Bldg., Milwaukee, Wis.



PITTSBURGH TRANSFORMERS

100% Overload

For 2 hours without injury, immediately following continuous full-load run

Pittsburgh Transformer Co.

Pittsburgh, Pa.

Sales Agents:

Delta-Star Electric Company, Chicago, Ill.

Stuart-Howland Company, Boston, Mass.

Interstate Electric Company, New Orleans, La.

Jaspersen Supply Company, St. Marys, Ohio

Rumsey Electric Company, Philadelphia, Pa.

Iron City Electric Company, Pittsburgh, Pa.

A. Hall Berry, New York, N. Y.

Henry L. Walker Company, Detroit, Mich.

Federal Sign System Electric,

Chicago, Ill.
Baltimore, Md.
Buffalo, N. Y.
Cincinnati, O.
Columbus, O.
Detroit, Mich.
Indianapolis, Ind.
Kansas City, Mo.
Lansing, Mich.
Lexington, Ky.
Louisville, Ky.
Milwaukee, Wis.
New York, N. Y.
Minneapolis, Minn.
New Orleans, La.
Oklahoma City, Okla.
Philadelphia, Pa.
Pittsburgh, Pa.
San Francisco, Cal.
St. Joseph, Mo.
St. Louis, Mo.
St. Paul, Minn.
Toledo, O.

TELEPHONE—ALL DEPARTMENTS, HAYMARKET 991

You Probably Know of
Henry Newgard & Co.

Let us tell you what we do:

We are Electrical Engineers, Manufacturers and Contractors.

We install power and lighting plants, generators and motors, and light and power wiring for all classes of buildings.

Upon this work we shall be glad to furnish estimates in any part of the United States and guarantee the lowest prices commensurate with the highest quality of work.

We are manufacturers of Switchboards, Panelboards, etc., also

Newgard Receptacles and Waterproof Globes

One of our specialties. Made of non-corrosive material; will last for years in any climate and save many times original cost in economy of lamps and sockets.

Our new type "Newgard" will take 60 and 100 Watt Tungsten Lamps.

Newgard Cut-out Boxes

fill all possible requirements and have many additional features which will interest buyers. They have not only been indorsed by the Underwriters, but are backed by personal guarantee.

Underwriters Stock Boxes appeal to every building contractor. A steady stream of testimonial letters as to their quality and service leads us confidently to assert that they are the best in the world.

Let us send you full particulars concerning any of our goods in which you may be interested.

We rewind any make of dynamo or motor, both alternating and direct. For quick service, write or telegraph us.

Henry Newgard & Co.
Chicago, Ill.

DOSSERT CONNECTORS for BUS BAR WORK

Where tubing and solid bus are to be tapped they are invaluable.

MINIMIZE HEAT LOSSES

by connecting cables to your large machines
for generating and converting current with

DOSSERT TERMINAL LUGS

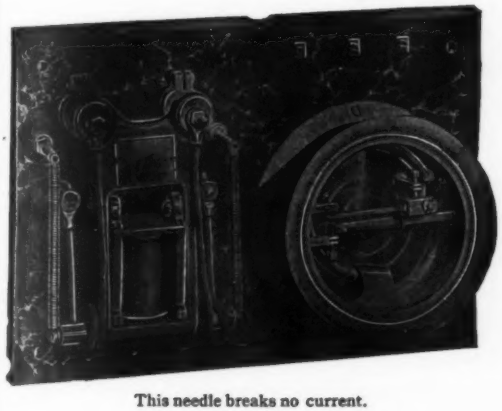
Troubles due to faulty joints are eliminated, while costs are reduced by the facility and simplicity of their installation.

Engineers who Design, Construct and Operate the most important Power Generating Stations unite in commending the good results obtained from the use of Dossert Connectors.

DOSSERT & COMPANY

H. B. LOGAN, President

242 West 41st Street NEW YORK



This needle breaks no current.

PERFECT CONTROL

OF PRESSURE

In TANKS, RESERVOIRS, etc., by starting and stopping motor-driven apparatus.

Sundh Gauge Type Regulator

is the most satisfactory. The construction consists of a silver-tipped contact lever attached to the tube and moving between two silver contact points on pressure fluctuations.

The screw on the right is used for adjusting to maximum pressure desired, and the lower screw on left hand is for adjusting for difference in pressure.

It can be set to operate on a pressure difference of about three to five per cent. A wider range may be obtained by screwing down the left-hand screw. The Sundh catalog explains all. Write for it.

SUNDH ELECTRIC COMPANY, New York, U.S.A.

True Conservation

POT-HEAD & CABLE COMPOUNDS

High or low melting point, hard or soft, brittle or flexible. Lots of 100 lbs. or car loads.

SEALING WAXES

Hard, black for dry batteries; soft, flexible seals for storage batteries; hard red cement for filling screw holes—any kind of seal.

SEALING CEMENT

Sticks, cakes, chunks or solid in a barrel. Black, brown, red or yellow. Good adhesion, high insulation, fine waterproofing, hard or soft.

INSULATING VARNISHES

Baking or air-drying; black or clear; oil-proof if you wish. Any kind made at a saving.

VARNISH CLOTH AND PAPER

Varnished silk, .002 to .010 in. thick; varnished cloth, .005 to .015 in. thick; varnished paper, .0015 to .015 in. thick. Tape any width, bias or straight.

ROPE PAPER

Press Board, fish paper—all kinds used for electrical purposes.

IMPREGNATING COMPOUND

For use with VACUUM IMPREGNATING APPARATUS. Quick impregnation. High insulation.

VULCANIZED FIBRE

Sheets, rods, tubes, washers—any shape. Black, red, gray, Special shapes. Machined to suit.

WRITE US

Have your insulation made toorder. It's better than the old way and costs no more—often less. Write

MITCHELL-RAND MFG. CO.
COR. JOHN & CLIFF STS., N.Y.

A List of

Mechanical Books For the Practical Man

Rogers' Erecting and Operating - $3.00

A practical handbook on Excavations, Foundations, Structures, Millwrighting, Shafting, Belting, Piping, Boilers, Engines, Installing Machinery, etc.

This volume is convenient in size, handsomely and durably bound in black cloth, having gold edges and titles; containing 600 pages, illustrated by over 500 drawings and illustrations of practical work. It is in every way a generously good book, both in contents and manufacture.

Rogers' Progressive Machinist - - $2.00

This is a valuable volume for all Metal Workers. The following are a few of the many subjects treated: Materials, Shop Drawing, Gearing, Bench and Vise, Tools and Machines, Lathe Work.

This book is handsomely bound in black cloth, with gold edges and titles, printed on fine paper, illustrated with 330 diagrams and drawings of practical work, containing over 360 pages of valuable information, and 1081 ready reference index for quick information.

Rogers' Advanced Machinist - - $2.00

This book is a companion volume to Progressive Machinist and is uniform in binding and style, but more advanced in the subject of Machine Shop Practice, containing about the same number of pages, illustrations, etc.

Hawkins' Calculations for Engineers $2.00

The Hand Book of Calculations is a work of Instruction and reference relating to the Steam Engine, the Steam Boiler, etc., and has been said to contain every calculation, rule and table necessary to be known by the Engineer, Fireman, and a steam user.

This work contains 330 pages and 150 illustrations; it is durably and handsomely bound, uniform in style and size with the "Instructions for the Boiler Room" and the "Catechism of the Steam engine"; it has gold edges and titles and weighs over 28 ounces

Hawkins' Steam Engine Indicator - $1.00

The work is designed for the use of Erecting and Operating Engineers, Superintendents, and students of Steam Engineering, relating, as it does, to the economical use of steam.

Fully illustrated, handsomely bound, and is in every way a high grade publication.

Hawkins' Steam Engine Catechism, $2.00

This work is gotten up to fill a long felt need for a practical book. It gives directions for running the various types of steam engines that are to-day in the market.

This is a rarely fine book, handsomely bound in green silk cloth, with full gold edges and titles; it contains 440 pages, 325 illustrations: in size it is 6x8¼ inches and weighs 2 pounds.

Hawkins' Steam Boiler Practice - $2.00

This book of instruction on boiler-room practice will be of great help to Firemen, Engineers and all others who wish to learn about this important branch of Steam Engineering.

This volume has 330 pages and 185 illustrations and diagrams. It is 6x8¼ inches in size and weighs 28 ounces. The binding is uniform with that of the "Calculations" and "Catechism of the Steam Engine," being bound in heavy green cloth with ornamental titles and edges of gold.

ALL BOOKS SENT POSTPAID UPON RECEIPT OF PRICE

Electrical Review Publishing Co.
WESTERN HEADQUARTERS FOR ELECTRICAL BOOKS
608 So. Dearborn St.
CHICAGO, ILL.

COMPLETE STOCK OF ALL ELECTRICAL BOOKS ON HAND

IF you are located in the "Illinois Range" with Chicago as the central distributing point, you can take advantage of our Specialized Service in supplying this territory, but we can and will supply you promptly no matter where you are located.

ELECTRICAL SUPPLIES APPARATUS EQUIPMENT

Prompt shipments, courtesy, and material whose merits must be demonstrated to us before we offer it for sale are the features forming the keystone of

"ILLINOIS SERVICE"

Among the quality materials we handle exclusively are

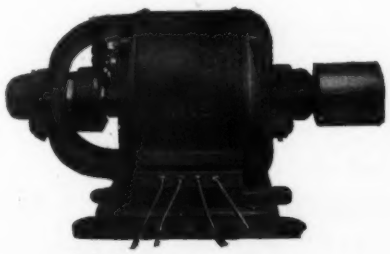
ADAMS-BAGNALL CONSTANT-POTENTIAL TRANSFORMERS

and

BELL MOTORS

Single Phase and Polyphase.

The Bell Single Phase Motors start on the repulsion principle and run as induction motors. The Polyphase Motor requires no expensive and complicated external compensator. It starts by merely throwing in the line switch.



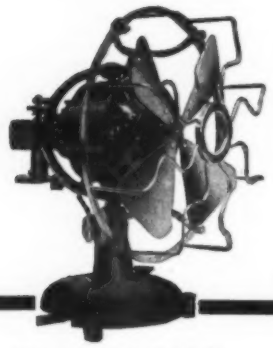
Bell Single Phase Motor

Is your name on our list? Make early application for the new big catalog now in preparation.

ILLINOIS ELECTRIC CO.

308 Madison Street, Chicago

MENOMINEE FANS



Menominee 8 in. Oscillating
DC or AC Universal

LINE IS COMPLETE

Induction, D C, Universal, 8 to 16 Inches

Stationary or Oscillating—Moderate Price—High Quality

CATALOGUE ON REQUEST

Menominee Electric Mfg. Co
Menominee, Mich.

COLONIAL FANS

Efficiency, durability, and moving the greatest amount of air on the minimum energy consumption are features of value distinctive of Colonial Fans and in addition their low cost gives you opportunity for greater profits.

"Quality Fans for Less Money"

embrace every size and type you may have a call for. A. C. or D. C., 8 to 16 inches, stationary or oscillating and readily convertible from desk to bracket types.

A New Catalog is ready. Write for a copy.

The Colonial Fan & Motor Co.
Warren, Ohio

A. C. and D. C. Motors, Rotary Converters, Generators.

The fact that a fan is running is sufficient to satisfy some people, but when you want air moved, use

Century

Alternating Current Fans

They can be converted into bracket fans without the use of extra parts and are all equipped with a five speed switch which gives a maximum amount of speed regulation.

Prompt shipments always from 24 branch stocks.

Century Electric Company

19th and Olive Streets
ST. LOUIS, MO.

New York Office—Hudson Terminal
30 Church Street

Delco Electric Household Specialties

Delco Toasters equipped with plug, green silk cord and "On and Off" Switch are of dainty appearance.

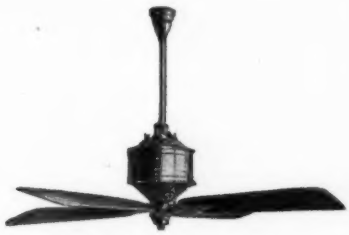
An intense heat is generated which insures a delicious piece of crisp toast, the bread being colored an even brown in less than two minutes, thus quickly converting the starch into dextrine.

An ideal gift for any time of year.

Diamond Electric Co.
7-17 Frederick St.
Binghamton, N. Y.

No. 46—Electrolier Ceiling Fan
Direct Current

Diehl
TRADE MARK



No. 44—Ceiling Fan
Direct Current

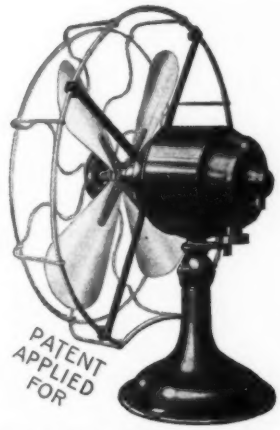
+ and —

The first sign means increase in efficiency, added sales points to convince the user and the fact that Diehl Pressed Metal Fans are a quick asset to the dealer. The minus sign signifies a 20 to 40 per cent reduction of weight, a notable feature when delivery expense and handling is considered.

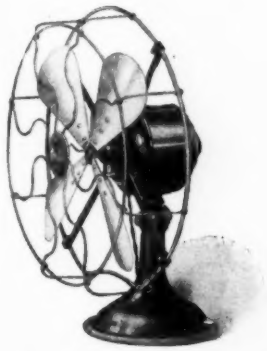
Write for information about the new line

All Sizes
All Types

Direct and Alternating Currents



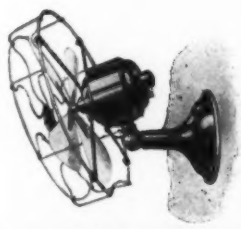
No. 07406—16-inch 60 cy. A. C.
Oscillator
Pressed Metal Type



No. 64—16-inch Direct Current
Desk Fan
Pressed Metal Type

DIEHL MANUFACTURING CO.

Elizabeth, New Jersey



No. 64—16-inch Direct Current Fan
in Bracket Position
Pressed Metal Type

Branches:

New York Philadelphia
Boston Chicago St. Louis
Williamsport, Pa. Washington, D. C.

No. 06406—16-inch A. C. Desk Fan
Pressed Metal Type

Headquarters for the
NATIONAL ELECTRIC LIGHT ASSOCIATION CONVENTION
June 2-6, 1913

Chicago's Most Modern Hotel

757 ROOMS
each with private bath circulating distilled ice water etc.

RATES

Room with bath
$2. $2.50, $3 $3.50, $4 & $5

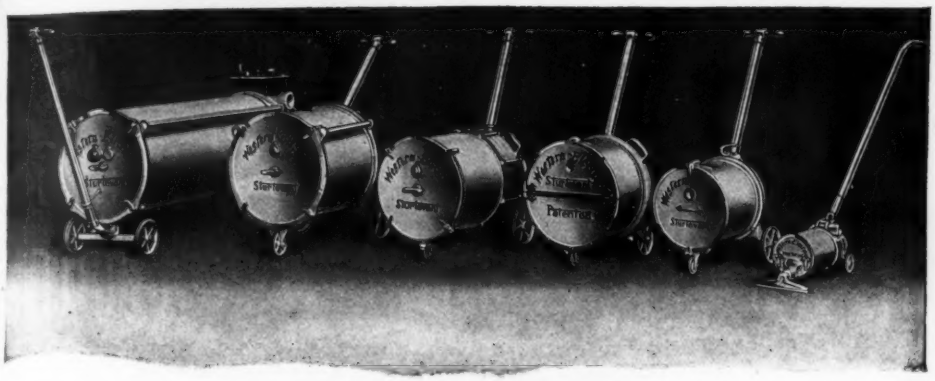
Room with bath for two
$3.50, $4, $5 & $6

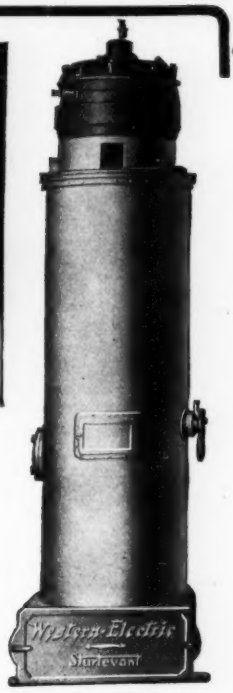
Check your baggage to the Hotel Sherman and two surprises will be in store for you. One surprise will come when you behold the excellence, completeness, and quiet magnificence of the place. Your second surprise will come when you see the very moderate amount of your bill. And when you leave the Hotel Sherman, it will be with regret, tempered by fond anticipation of the happy day when you can return.

Elbert Hubbard

HOTEL SHERMAN
City Hall Square
CHICAGO

Located in the Heart of the Business, Theatrical and Shopping Districts and nearest Loop Hotel to Convention Hall





A Size For Every Need

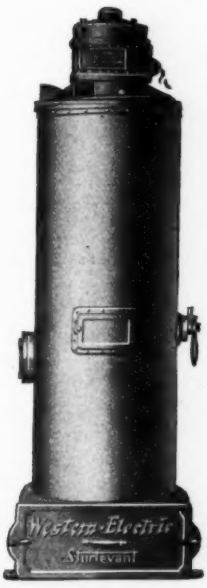
We Are Mutually Interested Mr. Central Station Manager

in selling or seeing sold to your customers the most reliable and economical vacuum cleaner obtainable.

Vacuum cleaner satisfaction means the use of other current-consuming appliances.

This interests you—the leveling up of your load curve—we are interested too—we sell and are popularizing not only vacuum cleaners but also fans, irons, toasters, in fact equipment for every electrical need.

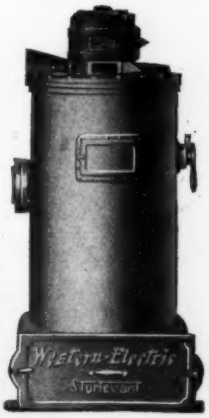
This is why all Central Stations should push the sale of



Western Electric
Sturtevant
Vacuum Cleaners

Let us talk it over. Or write if you prefer, to our nearest house

Be sure to visit our Booth, spaces Nos. 11 & 12
N. E. L. A. Convention, Chicago



WESTERN ELECTRIC COMPANY

Manufacturers of the 7,000,000 "Bell" Telephones

New York	Chicago	Kansas City	San Francisco	Montreal	London
Buffalo	Milwaukee	Oklahoma City	Oakland	Toronto	Berlin
Philadelphia	Pittsburgh	Minneapolis	Los Angeles	Winnipeg	Paris
Boston	Cleveland	St. Paul	Dallas	Calgary	Rome
Richmond	Cincinnati	Denver	Houston	Vancouver	Johannesburg
Atlanta	Indianapolis	Omaha	Seattle	Edmonton	Sydney
Savannah	St. Louis	Salt Lake City	Portland	Antwerp	Tokyo

EQUIPMENT FOR EVERY ELECTRICAL NEED

SEND US YOUR MOTOR REQUIREMENTS. WHY PAY MORE? YOU GET BETTER RESULTS FOR LESS MONEY WITH THIS MOST POWERFUL PERFECT MOTOR.

PROOF!!

There are over 20,000 of these Cyclone Drink Mixers on up-to-date bars and soda fountains and every user satisfied. There are sales for over a hundred thousand more. The profit is big; you can place some in your city. Send to-day for Bulletin 13.

We are small motor specialists. We designed and built this perfect little motor and will be pleased to build motors for your requirements. This is the motor you have been looking for. Give it the hardest test you can; we invite most thorough investigation.

You get twice the power for its size, because this H-B motor is designed and built absolutely perfect, mechanically and electrically, regardless of expense.

No motor has ever had a harder test than this little H-B drink mixer motor; no motor has ever received harder abuse.

This is the only motor on the market to-day that could stand such a test even for one day; and no motor troubles.

This test has proved beyond any question of doubt that the H-B motor is absolutely reliable. It is universal and can be used on both AC and DC circuits.

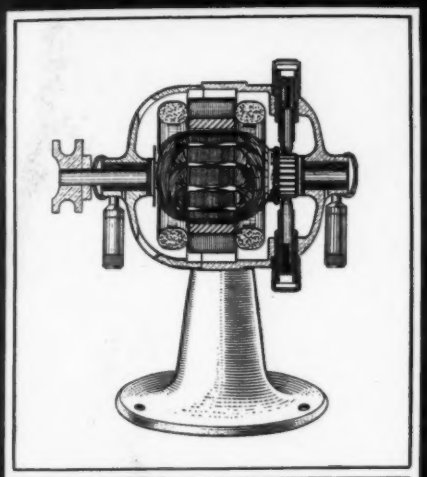
We have large manufacturing facilities for building motors, one of the most perfect factories in the west, with years of experience specializing on small motors.

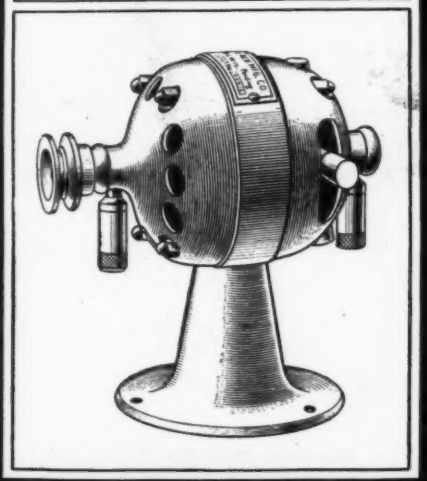
Send us your specifications to-day.

Send for Bulletin 13

Manufactured By
Hamilton-Beach Mfg. Co.
Racine, Wis.

WE WILL BUILD THIS MOST POWERFUL PERFECT SMALL MOTOR FOR ANY PURPOSE





ELIMINATE

All your motor troubles. Investigate the construction of the H-B motor. When you take the H-B motor apart you will find that no expense has been spared to make this the most perfect small motor ever built.

The Armature in the H-B motor is perfectly balanced, the shaft is ground and polished to a glass finish and requires no rocker bearings for a line up.

The laminations are made of the highest proof electric steel obtainable. We use only Belden's double silk covered wire, perfectly insulated with the best insulac on the market, going through three dippings and three bakings.

The commutator is as of a solid piece compressed under a ten ton pressure, the segments are pure mica and highest efficiency commutator copper.

The bearings are made of nickel babbitt, rifle bore finished. Our experience has proved that these bearings are the best obtainable.

The oiling arrangement is perfect, in the bearing is a small oil groove which accommodates the oil over the entire bearing surface. Every one knows that the bearings are the life of the motor and this is a detail that has been perfected in our motor.

Our facilities enable us to furnish this perfect H-B motor at a less cost than you are paying for inferior goods.

Send us your specifications today.

Send for Bulletin 14

SMALL MOTOR SPECIALISTS

Hamilton-Beach Mfg. Co.

Racine, Wis.

Cyclone Hair Dryer

Here is an absolutely perfect, instantaneous hot and cold, low priced efficient Hair Dryer. Just what you have been looking for. Light weight, Powerful, Durable and Fool-proof.

The demand for a good Hair Dryer is large and is increasing daily. The Cyclone has proved by test the best on the market.

The vital points of construction in the Cyclone are: First, the heating unit; second, the motor; third, the fan; fourth, the switch; fifth, efficiency and lightness.

The heating unit is distinctively different from any other on the market—indestructible—and its spiral radiating surface insures the greatest efficiency. The result is an instantaneous hot blast when you want it.

The motor in the Cyclone Hair Dryer is the famous Cyclone Drink Mixer Motor. The moment you turn on the switch there is life, heat, power, blast—without noise.

The fan is a peculiarly shaped one-piece casting—designed for highest efficiency, without noise. The switch is a three point contact of ample amperage capacity. One turn of switch gives a strong hot blast, two turns a strong cold blast.

The Cyclone has a good substantial appearance, with a handsome, highly polished aluminum casing. Operates both alternating and direct current.

Simple to operate, nothing to get out of order, all parts protected, absolutely impossible for hair to become tangled in the mechanism.

The perfect Hair Dryer at a reasonable price.

Send for Bulletin 15

SMALL MOTOR SPECIALISTS

Hamilton-Beach Mfg. Co.

Racine, Wis.

Cyclone Shoe Dryer

Necessity has created a demand for the Cyclone Shoe Dryer, a time saver that will dry one shoe while the other is being cleaned. We have had hundreds of inquiries for a practical Shoe Dryer at a popular price and for a long time we have been experimenting to obtain an absolutely perfect Shoe Dryer that would save time and thoroughly dry the leather, assuring a perfect shine without streaks or uneven polish marks.

The H-B Cyclone Shoe Dryer has become a necessity in every up-to-date shining parlor because it is a great time and labor saver, a trade getter and a popular, practical novelty.

The H-B Cyclone Shoe Dryer is portable, very light, efficient, durable and fool proof. Weighs only two pounds, simple to operate—all you have to do is to push the button in the handle.

The H-B Cyclone Shoe Dryer has a universal support which fits any stand so that one shoe can be dried while the other is being treated with polish. This makes it a wonderful time and labor saver and what the trade is looking for.

The H-B Cyclone Shoe Dryer is made of a highly polished aluminum casing enclosing a powerful little H-B motor which drives the fan throwing a strong blast of air which circulates around every part of the shoe.

This adds another new and attractive article to your line of current consuming devices and will popularize the use of labor saving conveniences and specialties.

Send to-day for Bulletin 16

LABOR SAVING SPECIALTIES

Hamilton-Beach Mfg. Co.

Racine, Wis.

NEW LIFE FOR YOU!!

All leading physicians are prescribing H-B Vibrators in place of the old-fashioned hot-water bag for stimulating the blood circulation and relieving congestion.

The moment you apply the H-B Vibrator to any part of the body it starts and equalizes perfect circulation; it does the work a hundred times faster than the hot-water bag and doesn't leave the same bad after effects.

We call the H-B Vibrator "New Life" Vibrator, because the moment you apply it you instantly feel the soothing, invigorating, vitalizing effects of the increased blood circulation. When you are tired a few minutes' treatment up and down your spine will work wonders. You don't have to wait in doubt for the proof—the first treatment will convince you.

You relieve the pain the moment you apply "New Life" Vibrator for Indigestion, Lumbago, Backache, Rheumatism, Headache or Neuralgia—Wonderful results are obtained in a few minutes' application.

Every one knows there isn't a home without a hot-water bag, and as soon as the merits of "New Life" Vibrators are known there won't be a home complete without this Vibrator.

You can reap the benefits of our large national advertising campaign and make big money handling "New Life" Vibrators. The profits are great and your co-operation with us will be well compensated.

Send today for Bulletin 15

SMALL MOTOR SPECIALISTS

Hamilton-Beach Mfg. Co.

Racine, Wis.

POWER FOR YOU!!

"New Life" Vibrator has become a necessity in every home and is a very profitable article to add to your line of power-using devices. We can prove where thousands of new installations have been made in homes for the use of "New Life" Vibrator.

The moment you apply "New Life" Vibrator you feel the soothing, strengthening, invigorating, vitalizing, health-giving power of the increased circulation of the blood. A few minutes' treatment up and down your spine will prove and work wonders. "New Life" Vibrator is endorsed by the medical profession as a boon to suffering humanity.

Because all of Nature's Health-Giving Power, Strength-Giving Power, Nerve-Building Power is in the blood, all the strength and power of the food you eat is absorbed into the blood and distributed through your entire body. Where the circulation is impaired a person becomes weak and sickly.

A weak, thin arm or leg is proof positive of poor circulation. If you exercise this weak arm or leg, day after day, it will soon become powerful and healthy. "New Life" Vibrator will give this power and health quicker and without loss of energy and the resulting fatigue.

New Life, Strength and Power are felt the moment you start the free-flowing circulation of the blood and distribute the strength and building power of the food you eat. What is the use of eating strength-giving food when you don't distribute it through the entire body and build it strong and healthy? Perfect circulation develops the strong and robust body of the athlete.

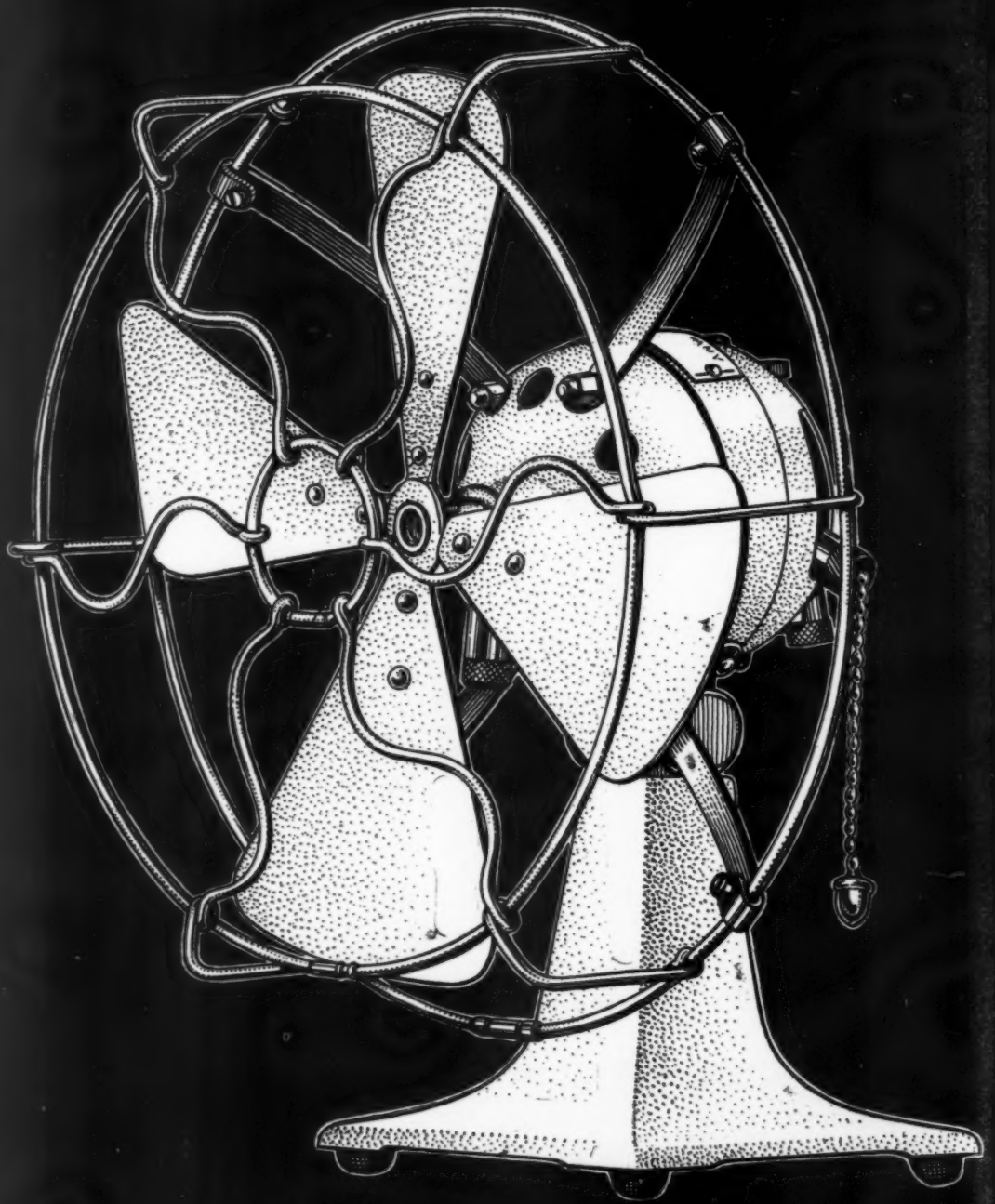
Send today for Bulletin 15

SMALL MOTOR SPECIALISTS

Hamilton-Beach Mfg. Co.

Racine, Wis.

CYCLONE 8 IN. FAN



MANUFACTURED BY

HAMILTON-BEACH MFG. CO.

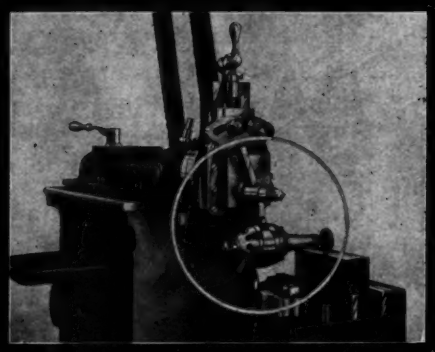
RACINE. WIS.

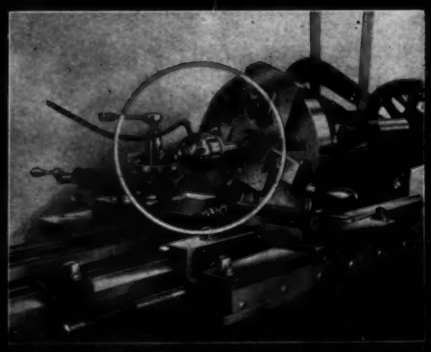
H-B Portable Grinder

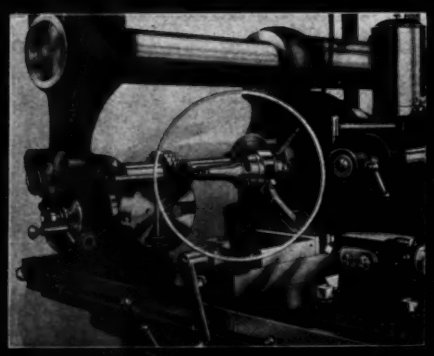
The Handy Machine Shop Tool

Runs on direct and Alternating Current

Universal Fits any Tool Post







The H-P Portable Grinder is an absolute necessity in every tool room and machine shop. Show any tool maker the design of the H-B Grinder and he will tell you that there isn't a more handy and necessary tool for all practical purposes than the H-B Portable Grinder.

The H-B Portable Grinder can be used for both internal and external grinding, has a universal support that fits any lathe, miller and shaper, and will accurately grind down to one ten thousandth any hard tempered piece of steel, milling cutter, reamer, die and tool. Any kind of felt or oil stone wheels can be used for any finish desired.

The first and most important point is the motor. After years of experience we have designed and built a motor free from all vibration and especially adapted for the H-B Portable Grinder, and which is the only motor on the market giving the wheels the right surface speed to do quick and accurate work.

The H-B Portable Grinder is fool proof, absolutely universal, can be run on both direct and alternating currents, comes with ten feet of cord and attachment plug, has a very handsome, durable and substantial appearance and soon becomes the pride and pet of every one in the tool room.

The H-B Portable Grinder is another profitable article to add to your line of power-consuming and labor-saving devices that every central station is popularizing.

Send today for Bulletin 16

LABOR SAVING DEVICES

Hamilton-Beach Mfg. Co.

Racine, Wis.

Central Station Efficiency

depends on and is in direct proportion to the efficiency of the individual workers, whether they be in the commercial department selling current or in the engineering branches, generating it. Individual efficiency is promoted by practical knowledge, gained not only from daily contact with one's work but by close study of the results obtained by others.

Central stations are well in the lead in the efficiency movement now taking hold everywhere. A great many are now organizing schools for the training of efficient employees. Schools, and in some instances classes, held in the evening or on Saturday afternoons are helping the men to better positions and the companies to more efficient service. All the big companies now are training their engineering departments employees as well as those in the commercial branches.

For training Central Station men in all departments, there's nothing better than

ELECTRICITY

Experimentally and Practically Applied

By SYDNEY W. ASHE

Author of "Electric Railways." Formerly Instructor in Physics and Electrical Engineering, Brooklyn Polytechnic Institute.

Besides being an excellent book for use in classes, this book is just the thing for home study for the man who can't join a class because there isn't one in his neighborhood.

350 Pages 5x7 Inches

422 Illustrations

Price $2.00 Net

We have the most complete Catalog of Electrical Books ever issued. Sent free.

One of the 422 Illustrations

Principles

Here is a systematic text—one that central station workers can follow—because it was written for them. This book is the direct result of a series of experimental lectures delivered by Mr. Ashe, to employees of some of our largest central stations. This book explains the best electrical practice. It points out the best methods and explains why they are best. It aims to give specific basic knowledge in a plain, straightforward style that central station men want. It is a practical book for practical men developed along practical lines.

Experiments

176 of them—easy, simple experiments that drive home the theory and practice that the central station man is likely to meet while on the job—no matter what department he's in. And these experiments require no elaborate apparatus — no special laboratory equipment but simply make use of the equipment of the average plant. All of these experiments deal with the practical electrical operations in generation, application, installation, transmission and service.

Electrical Review Publishing Co.

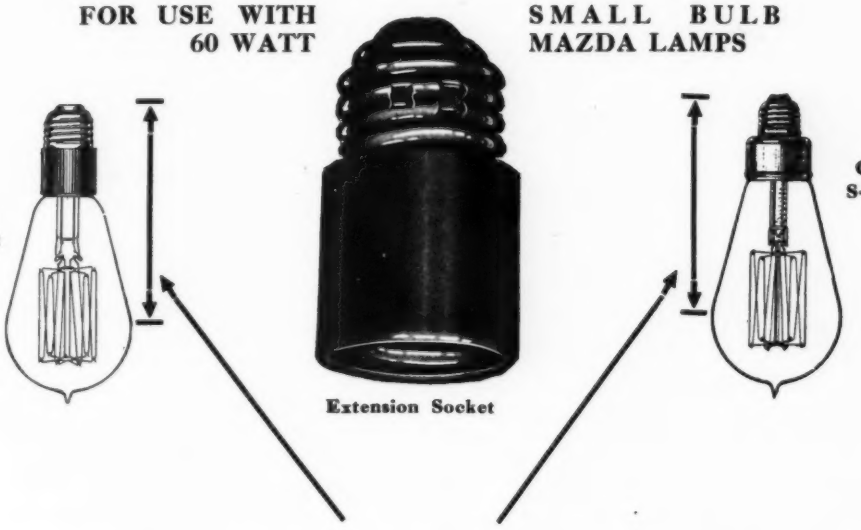
Western Headquarters for Electrical Books

608 S. Dearborn Street, Chicago

The Trade Mark of the Largest Electrical Manufacturer in The World.

Socket Extension

FOR USE WITH 60 WATT SMALL BULB MAZDA LAMPS



SAME DISTANCE FROM CENTER OF CONTACT TO CENTER OF LIGHT SOURCE

This Socket Extension has been developed to permit the use of the new 60 watt, 100-130 volt, Mazda lamp in the small (S-21) bulb, unskirted base, with reflectors designed for the old 60 watt, large (S-24½) bulb, skirted base lamp, where the same distribution of light is required.

The small bulb, 60 watt lamp, on account of its more desirable size and less cost of initial reflector equipment, will undoubtedly be adopted in all new installations. In order to permit of a reduction of stock of 60 watt lamps maintained by our customers to one size of bulb and to take advantage of the more prompt deliveries to be expected on the latter lamp, the Socket Extension may be used with all renewals of 60 watt, small bulb, in large bulb installations. This Socket Extension locks in the socket, thus preventing the Extension being thrown away with discarded lamps.

For sale by the various district offices.

General Electric Company

Edison Lamp Dept., Harrison, N. J.

List of Sales Offices on Second Page Before Editorial Section

4251

This Trade Mark The Guarantee of Excellence on Goods Electrical.

This Trade Mark The Guarantee of Excellence on Goods Electrical.

A New Electric Range (Type R)

The General Electric Company has perfected a new range of remarkable efficiency; it is the result of years of research by its engineers.

The chief reason for this high efficiency is the use of an entirely new discovery in heat insulating material — exclusive to the G-E range. The thermal resistivity of this new insulating substance is higher, and the thermal lag is less, than any material heretofore used.

The maximum connected load of the new range is only 3600 watts, compared with 6300 watts of the present types of ranges (like the Type D-40)—this, in addition to its greater cooking capacity (for 15 persons). The maximum demand, however, in cooking a long series of menus was not over 2600 watts.

Note the cooking compartments, individually heated and insulated, so that practically all the heat goes into cooking.

The hot plates are not only quick heating, but also insulated individually.

All metal parts are non-oxidizing.

The quality of material, construction and finish gives this new range a very handsome appearance—making it an ornament to any kitchen.

The equipment of the Type R-1 Range, now ready, is as follows:

Two quick heating, insulated hot plates, each 1000 watts high, 250 watts low.
Three insulated vegetable cooking compartments, each 200 watts.
One insulated oven, 18x18x12 inches, 1000 watts high, 250 watts low.
One radiant heat broiler (in top of oven).
Three aluminum utensils for cooking compartments.
Metal construction throughout, the exterior being finished in Wellsville Blue and "Gun Metal" (Baurbarff).

General Electric Company

List of Sales Offices on Second Page Before Editorial Section

4253

The Trade Mark of the Largest Electrical Manufacturer in The World.

The Trade Mark of the Largest Electrical Manufacturer in The World.

Calibrating Type I-10 Meters

The accuracy of type I-10 watthour meters is well known. They are calibrated by standards (at the end of the testing bench) which are carefully checked twice a day. The calibration is made by experienced testers whose work is minutely inspected, one inspector supervising the work of four testers. Immediately after test is completed the meter cover is placed in position and is not removed thereafter. This protects the meter mechanism, excludes dust, and insures that no change in calibration occurs while the meter is being prepared for shipment.

The large production of I-10 meters and our excellent facilities for doing every part of the work in a most efficient way make it possible for us to sell this high grade meter at a very low price.

If you are not using I-10 meters now, send us a trial order. If you are using them, their service speaks for itself.

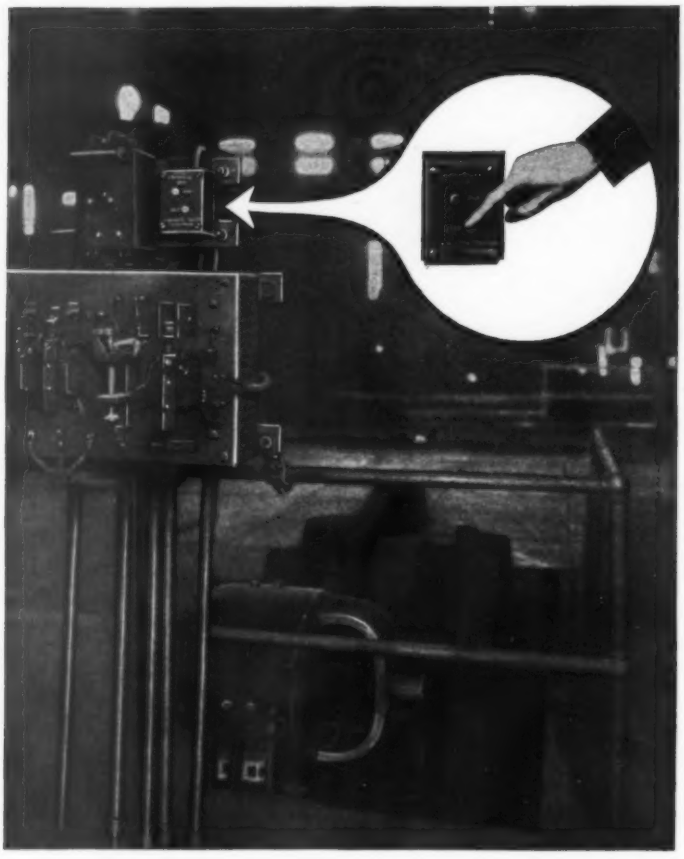
General Electric Company

List of Sales Offices on Second Page Before Editorial Section

4138

This Trade Mark The Guarantee of Excellence on Goods Electrical.

This Trade Mark The Guarantee of Excellence on Goods Electrical.



No More Burnt Armatures

This motor drive was difficult to operate with the older methods of control. The machine, cutting cold steel bars three inches square, was invariably started too quickly. Careless operators were injured, and motor armatures burned out.

Lost production resulted in financial losses in addition to the cost of repairs.

Now G-E Industrial Control

Prevents These Losses

Any operator can start the motor correctly by simply pushing the button.

It is impossible to start too quickly, for the panel prevents overloads during starting as well as when the machine is in operation. The saving in armature maintenance alone has justified the change in equipment. In addition the plant manager knows that his electrical equipment is proof against injuries to either the operator or the apparatus, and that continuous and uniform production can be relied upon from machines equipped with the new push button method of control.

Call, write or telephone our nearest office for further details and special information on our exchange proposition.

General Electric Company

List of Sales Offices on Second Page Before Editorial Section

4027

The Trade Mark of the Largest Electrical Manufacturer in The World.

The Trade Mark of the Largest Electrical Manufacturer in The World.

Silent Power Salesmen

For years, each month, approximately a million copies of the industrial papers of this country have contained advertisements of motors made by the General Electric Company. These advertisements, wherever practicable, urge the use of central station power—your power—and many of these silent salesmen are read in your city.

The illustration above shows some of the papers used—papers which are read for the news in their industry as you read your electrical papers.

Go out among your customers and ask what papers they read—look into them and very probably you will find a General Electric Company advertisement.

An immense field of buyers is reached by these advertisements—buyers being prepared for your salesmen—buyers to whom apparatus is being sold requiring current—probably yours.

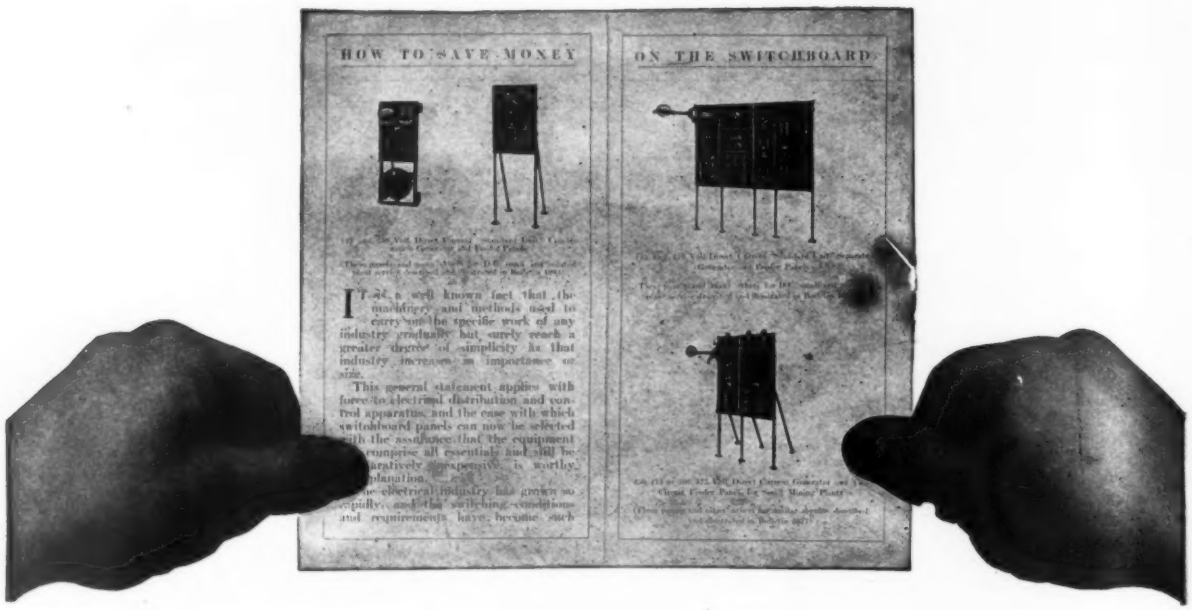
This publicity is growing greater every year. It will pay you to sell apparatus which is so well advertised.

General Electric Company

List of Sales Offices on Second Page Before Editorial Section 4210

This Trade Mark The Guarantee of Excellence on Goods Electrical.

This Trade Mark The Guarantee of Excellence on Goods Electrical.



G-E Standard Unit Switchboards

The G-E "Standard Unit" method of manufacturing and selling switchboards helps you save time, trouble and money when you buy a switchboard.

All the engineering and drafting work on these units has been finished so that the actual work of building your switchboard can be started as soon as your order is received.

From a G-E Switchboard bulletin you can select the "standard unit" generator panels, feeder panels, exciter panels or other equipment needed to make up a complete switchboard for your plant.

This plan saves you the trouble of writing specifications and approving drawings. It saves the time that would otherwise be required for engineering and drafting, and it saves you money in the reduced price of the switchboard, due to eliminating engineering and drafting expense on your individual order.

Our booklet "How to save money on the Switchboard" illustrated above, explains this plan in detail and illustrates a number of types of G-E Standard Unit Switchboards.

Our nearest office will send you a copy on request.

General Electric Company

List of Sales Offices on Second Page Preceding Editorial Section

4179

The Trade Mark of the Largest Electrical Manufacturer in The World.

The Trade Mark of the Largest Electrical Manufacturer in The World.

This page is prepared for the ready reference of the readers of the Electrical Review and Western Electrician. To insure correspondence against avoidable delay, all communications to the company should be addressed to the sales office nearest the writer.

General Electric Company

Sales Offices

ATLANTA, GA., Third National Bank Building.
BALTIMORE, MD., Electrical Building.
BIRMINGHAM, ALA., Brown-Marx Building.
BOISE, IDAHO, Idaho Building.
BOSTON, MASS., 84 State Street.
BUFFALO, N. Y., Electric Building.
BUTTE, MONTANA, Electric Building.
CHARLESTON, W. VA., Charleston National Bank Bldg.
CHARLOTTE, N. C., Commercial National Bank Building.
CHATTANOOGA, TENN., James Building.
CHICAGO, ILL., Monadnock Building.
CINCINNATI, OHIO, Provident Bank Building.
CLEVELAND, OHIO, Citizens Building.
COLUMBUS, OHIO, Columbus Savings & Trust Bldg.
DAVENPORT, IOWA, Security Building.
DAYTON, OHIO, Schwind Building.
DENVER, COLO., First National Bank Building.
DETROIT, MICH., Dime Savings Bank Bldg.
(Office of Agent.)
ELMIRA, N. Y., Hulett Building.
ERIE, PA., Marine National Bank Building.
INDIANAPOLIS, IND., Traction Terminal Building.
JACKSONVILLE, FLA., Florida Life Building.
JOPLIN, MO., Miners' Bank Building.
KANSAS CITY, MO., Dwight Building.
KEOKUK, IOWA, Monarch Building.
KNOXVILLE, TENN., Bank & Trust Building.
LOS ANGELES, CAL., 124 West Fourth Street
LOUISVILLE, KY., Paul Jones Building.
MEMPHIS, TENN., Randolph Building.
MILWAUKEE, WIS., Public Service Building.
MINNEAPOLIS, MINN., 410 Third Ave., North.
NASHVILLE, TENN., Stahlman Building.
NEW HAVEN, CONN., Malley Building.
NEW ORLEANS, LA., Maison-Blanche Building.
NEW YORK, N. Y., 30 Church Street.
OMAHA, NEB., Union Pacific Building.
PHILADELPHIA, PA., Witherspoon Building..
PITTSBURG, PA., Oliver Building.
PORTLAND, ORE., Electric Building.
PROVIDENCE, R. I., Union Trust Building.
RICHMOND, VA., Mutual Building.
ROCHESTER, N. Y., Granite Building.
SALT LAKE CITY, UTAH, Newhouse Building.
SAN FRANCISCO, CAL., Rialto Building.
SCHENECTADY, N. Y., G-E Works.
SEATTLE, WASH., Colman Building.
SPOKANE, WASH., Paulsen Building.
SPRINGFIELD, MASS., Massachusetts Mutual Bldg.
ST. LOUIS, MO., Wainwright Building.
SYRACUSE, N. Y., Post-Standard Building.
TOLEDO, OHIO, Spitzer Building.
WASHINGTON, D. C., Evans Building.
YOUNGSTOWN, OHIO, Wick Building.

FOR TEXAS, OKLAHOMA and ARIZONA Business refer to
Southwest General Electric Company (Formerly Hobson Electric Co.)
DALLAS, TEX., 1701 N. Market Street.
EL PASO, TEX., 500-2 San Francisco Street.
HOUSTON, TEX., 1114 Franklin Street.
OKLAHOMA CITY, OKLA., Insurance Building.

FOREIGN SALES OFFICES.
SCHENECTADY, N. Y., Foreign Dept.
NEW YORK, N. Y., 30 Church St.
LONDON, E. C., ENGLAND, 83 Cannon St

For all CANADIAN Business refer to
CANADIAN GENERAL ELECTRIC CO., LTD., Toronto, Ont.

General Offices, Schenectady, N. Y.

Edison Lamp Department, General Sales Office, Harrison, N. J.

Products and Purpose

The General Electric Company is the largest electrical manufacturer in the world. With few exceptions, its products comprise every kind of apparatus and machinery used in the generation, transmission, distribution and use of electrical energy. Its thousands of products, in use in all parts of the world, have established the G-E Trade-Mark as the Guarantee of Excellence on Goods Electrical. As in the past the General Electric Company will continue to be foremost in all developments and improvements tending toward the perfecting of present electrical service and its extension into new fields of usefulness.

This Trade Mark The Guarantee of Excellence on Goods Electrical.

MODEL 269, Single Range Portable Voltmeter. (One-quarter Size.)

WESTON

Miniature Precision Instruments for Direct Current

MODEL 280, Triple Range Portable Volt-Ammeter. (One-quarter Size.)

A new group of very small Indicating Instruments.

COMPACT—ACCURATE—DURABLE—BEAUTIFUL

PORTABLE

Voltmeters, Millivoltmeters, Volt-Ammeters, Ammeters, Mil-Ammeters are supplied in single, double and triple ranges.

The Volt-Ammeter comprising six instruments in one.

This group also includes BATTERY TESTERS.

MODEL 267, Switchboard Ammeter. (One-quarter Size.)

SWITCHBOARD

Voltmeters Volt-Ammeters Ammeters Mil-Ammeters

This new line of instruments represents the latest development of the pivoted moving coil, permanent magnet type for low ranges.

The refinement of design and mechanical work in them has been carried to a degree which would appear to be almost impossible of accomplishment, if the results were not evident in the instruments themselves.

MODEL 268, Switchboard Volt-Ammeter. Reads Amperes. Press Button for Volts. (One-quarter Size.)

They embody characteristics which have made the well known Weston Standards famous throughout the world.
They are accurate, dead beat and extremely sensitive.
They may be left continuously in circuit at full load without injury and are shielded against the external electrical and magnetic influences of other apparatus in their vicinity.
They are substantially constructed and may be safely sent long distances through the mails and will withstand an extraordinary amount of vibration without injury.
They have the longest scale ever provided in instruments with equal length of pointer.
Each model has been thoroughly tested under the most severe conditions of service and in experiments extending over more than one year.
The portable instruments may be conveniently carried in the coat pocket.
The prices have been established upon so low a scale that any one may possess one or more of these remarkable instruments at moderate cost
If you cannot obtain the instruments desired from your dealer, write us.
The several models and ranges offer a selection from over 300 different combinations, listed in Bulletin No. 6. Will be mailed upon request.

WESTON ELECTRICAL INSTRUMENT COMPANY,

Main Office and Works: NEWARK, N. J.

New York, 114 Liberty St.
Chicago, 1504 Monadnock Block.
Boston, 176 Federal St.
Philadelphia, 342 Mint Arcade.
Birmingham, Brown Marx Bldg.
St. Louis, 915 Olive St.
Denver, 231 15th St.
San Francisco, 682 Mission St.
Cleveland, 1729 E. 13th St.
Detroit, 44 Buhl Block.
Montreal, Winnipeg, Vancouver, Calgary — Northern Electric & Mfg. Co.
Toronto, 76 Bay St.
Paris, 12 Rue St. Georges.
London, Audrey House, Ely Place, Holborn.
Berlin, Genest Str. 5, Schoenberg.
Johannesburg, So. Africa, F. Peabody Rice, Standard Bank Buildings, Harrison St.

OKONITE

INSULATED

WIRES & CABLES

The STANDARD *for* RUBBER INSULATION

OKONITE

continues to satisfy years after its purchase has been forgotten.

THE OKONITE COMPANY
253 Broadway. New York

AMERICAN CROSS-ARM CO.

CHICAGO

PARANITE

RUBBER COVERED WIRES & CABLES

are made to meet all requirements of New Code Specifications

Underground, Aerial, Submarine and inside Use. Telephone, Telegraph, Fire-Alarm, Electric Light and Power, Wires and Cables

"The Best for Every Purpose"

Indiana Rubber & Insulated Wire Co.
Jonesboro Indiana

WESTON ELECTRICAL INSTRUMENTS
WARD LEONARD ELECTRIC CONTROLLING DEVICES
WARD LEONARD AUTOMATIC DYNAMO
LIGHTING AND STARTING SYSTEMS FOR AUTOMOBILES

BADT-WESTBURG ELECTRIC CO.

1504 Monadnock Block Chicago

Telephone, Harrison 745

APOLLO **Special ELECTRICAL SHEETS**

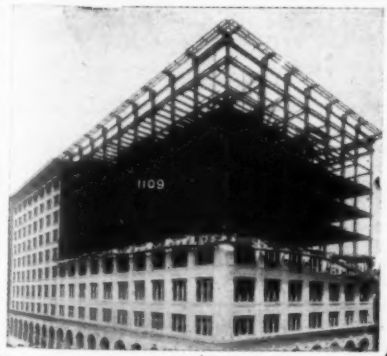
Of Silicon Alloy Steel, Patented. Highest grade Electrical Sheets manufactured for transformers, dynamos and motors; insuring minimum heating, maximum capacity, non-aging. Other standard sheets are American Armature, U. S. Electrical, and Pole Face. Write for full information.

AMERICAN SHEET AND TIN PLATE COMPANY, Pittsburgh

AMERICAN SHEET & TIN PLATE CO. APOLLO SPECIAL ELECTRICAL TRADE MARK REGISTERED PITTSBURGH

AMERICAN BRIDGE COMPANY OF NEW YORK
HUDSON TERMINAL-30 CHURCH STREET, NEW YORK

Manufacturers of Steel Structures of all classes particularly **BRIDGES AND BUILDINGS**



Rothschild Building
Chicago, Ill.

NEW YORK, N. Y., Hudson Terminal, 30 Church Street
Philadelphia, Pa., Pennsylvania Building
Boston, Mass. John Hancock Bldg.
Baltimore, Md., Continental Trust Building
PITTSBURGH, PA. . . . Frick Building
Rochester, N. Y. . . . . Powers Block
Buffalo, N. Y. . . Marine National Bank
Cincinnati, Ohio . . Union Trust Building
Atlanta, Ga. . . . . Candler Building
Cleveland, Ohio . . Rockefeller Building
Detroit, Mich., Beecher Ave. & M.C.R.R.

CHICAGO, ILL., . Commercial National Bank Building
St. Louis, Mo., Third Nat'l Bank Building
Denver, Colo., First Nat'l Bank Building
Salt Lake City, Utah, Walker Bank Building
Duluth, Minn. . . . . Wolvin Building
Minneapolis, Minn., 7th Ave. & 2d St., S. E.

Pacific Coast Representative:
U. S. Steel Products Co., Pacific Coast Dpt.
SAN FRANCISCO, CAL., Rialto Building
Portland, Ore. . . . Selling Building
Seattle, Wash., 4th Ave. So., Cor. Conn. St.

Export Representative: United States Steel Products Co., 30 Church St., N. Y.

Buyers' Guide of Electrical Material

A Complete List of the Manufacturers of Electrical Material, Under Proper Classification, Is Published in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN in the First Issue of Each Month, Beginning on this Page.

ELECTRICAL EXCHANGE

POSITIONS WANTED

The rate for "Positions Wanted" advertisements is two cents per word, minimum charge 50 cents an insertion, payable in advance. Remittances and copy should reach this office not later than Monday 12 o'clock noon, for the next succeeding issue.

Replies may be sent in care of Electrical Review and Western Electrician, 608 So. Dearborn Street, Chicago, or 13-21 Park Row, New York.

POSITION WANTED—Strong specialty salesman, age 36, desires to cover Cleveland territory for manufacturer. Eight years' electrical selling experience. Best references. Address No. 1600, Electrical Review & Western Electrician, Chicago.

POSITION WANTED—By young man of 25 as all around repairman and wireman. Have had seven years' experience at wiring, meter testing, plant operation, etc. Am unmarried, sober and industrious. Town of three to five thousand in northern state preferred. Address, No. 1594, Electrical Review and Western Electrician, Chicago.

POSITION WANTED—Solicitor and estimator. Age 28 years, single, technical graduate, 10 years' experience in electrical contracting (light and power installation). Will consider any location in United States or Canada. Address, P. Hansen, No. 331 Runyon St., Newark, N. J.

HELP WANTED

The rate for "Help Wanted" advertisements is three cents a word, minimum charge $1.50 an insertion, payable in advance. Remittances and copy should reach this office not later than Monday, 12 o'clock noon, for the next succeeding issue.

Replies may be sent in care of Electrical Review and Western Electrician, 608 So. Dearborn Street, Chicago, or 13-21 Park Row, New York.

WANTED—Draftsmen, experienced in electrical and architectural drawing. Apply Fort Wayne Electric Works of G. E. Co., Fort Wayne, Ind.

WANTED—Superintendent and estimator familiar with Electrical Contracting can secure position with an old established firm in New York City. State fully experience and salary. Apply No. 1599, Electrical Review and Western Electrician, Chicago.

WANTED—Live salesman to handle our line of Hard Vulcanized Fibre Sheets, Rods, Tubes, Washers, Special Shapes and Insulating Papers as a side line on a commission basis. Address Concrete Fibre Co., Norristown, Pa.

MISCELLANEOUS

The rate for "Miscellaneous" advertisements is three cents a word, minimum charge $1.50 an insertion, payable in advance. Remittances and copy should reach this office not later than Monday, 12 o'clock noon, for the next succeeding issue.

Replies may be sent in care of Electrical Review and Western Electrician, 608 So. Dearborn Street, Chicago, or 13-21 Park Row, New York.

FOR SALE — Prosperous electrical contracting and supply business in growing city of 10,000 in Texas. Small competition. Central Station turns over all orders, including wiring and fixtures. Stock invoices $3,000. Good reasons for selling. Write today. Address Box 1596, Electrical Review and Western Electrician, Chicago.

WANTED—Second-Hand Electrical Equipment. One 300 K. W. 2,300-volt, 3-phase, 60-cycle, 3-bearing, belted type A. C. generator, either 450 or 360 r. p. m. Two 75 H. P. 2,300-volt, 3-phase, 60-cycle, 900 r. p. m., 2-bearing, squirrel cage, induction motors, with starters. Give full particulars regarding make, type, condition, price and delivery of above apparatus. Equipment must be guaranteed in first class condition. A. C. Wood, Consulting Engineer, 818 Pennsylvania Building, Philadelphia, Pa.

FOR SALE—1—100 HP. Oil Engine; 15,000 gal. storage oil tank; 1—60 KW. Generator, with exciter, 2,300 volt, 3 phase, 60 cycle; 1 air tank and pump; everything to make complete outfit. Good operative condition. Can be seen in operation. Reason for selling—too small. Must be moved by August 1st. Spencer Light and Water Works, Spencer, Iowa.

FOR SALE—at a decided bargain: Three 100 K. W. oil insulated self cooling Westinghouse transformers, single phase, 25 cycle. 12,000 volts high tension—440 volts low tension. These transformers are in first-class condition. Reason for selling, require more capacity. Address, Northern Coal & Dock Co., Superior, Wis. or St. Paul, Minn.

FOR SALE—Electric Light Plant and Feed Mill at Brussels, Ontario. Population, 1,000; number of consumers, 116; meters, 72; street lights, cluster, 20; voltage, 230; cycles, 60. Earnings last year over 20 per cent on basis of selling price. Address E. E. Dillon, 1039 University Ave., Madison, Wis.

FOR SALE—40 Arc Lamps, No. 9525 General Electric Single Globe Edison Type D. C. Enclosed, 5 ampere, 108 volts, Black enamel casing, exclusive of outer globes. Any reasonable offer will be accepted. Scannevin & Potter, 250 Thames St., Newport, R. I.

FOR SALE — Contracting business in city of 6,000 in North Dakota. Established eight years. Reason for selling, haven't time to look after it. Business consists of wiring, electric supplies and bicycle repairing. Sales and contracting average $500.00 per month. Snap for hustler. Terms. Address No. 1598, Electrical Review and Western Electrician, Chicago.

FOR SALE — A well established electrical contracting and retail Chandelier business, also a well equipped small Chandelier Factory with an established mail order business, in a thriving city of 25,000 inhabitants. Will sell separately or together. Address Craighead Plumbing & Electric Co., No. 910 Main St., Richmond, Ind.

ELECTRICAL ADVERTISING — Commissions for the preparation of electrical publicity matter—catalogs, bulletins, pamphlets, follow-ups, newspaper and magazine copy, etc.—accepted on contract or fee basis by experienced and successful advertising writer. Charges reasonable. Address Box 1597, Electrical Review and Western Electrician, Chicago.

PROPOSALS

The rate for "Proposal" advertisements is fifteen cents per line, nonpareil measurement, payable in advance. Remittances and copy should reach this office not later than Monday, 12 o'clock noon, for the next succeeding issue.

Treasury Department, Office of the Supervising Architect, Washington, D. C., May 5, 1913. Sealed proposals will be received at this office until 3 o'clock p. m. on the 9th day of June, 1913, and then opened, for a conduit and wiring system in the United States Marine Hospital, San Francisco, Cal., in accordance with drawing and specification, copies of which may be had at this office or at the office of the Supervising Superintendent of Construction, U. S. Post Office, San Francisco, Cal., at the discretion of the Supervising Architect.
O. Wenderoth, Supervising Architect.

EDUCATIONAL

The rate for "Educational" advertisements is 15 cents per line, nonpareil measurement, payable in advance. Remittances and copy should reach this office not later than Monday, 12 o'clock noon, for the next succeeding issue.

ROSE POLYTECHNIC INSTITUTE

Terre Haute, Ind. A college of Engineering; courses in Mechanical, Electrical, Civil and Chemical Engineering and Architecture. Extensive shops, expenses low; 39th year. Catalog C. L. MEES, Pres.

THE STANDARD OF THE WORLD
TRADE GONDA MARK
The Leclanché Battery Co.
NEW YORK

GALES COMMUTATOR COMPOUND
50 Cents per Stick. $5.00 per Dozen
FREE Sample Stick

WANTED
You who are Troubled with Sparking and Cutting of Commutators to Use—The only article that will Prevent sparking. Will keep the commutator in good condition and Prevent Cutting. Absolutely Will Not Gum the Brushes. It will put that high gloss on the commutator you have so long sought after.

For Sale by All Supply Houses, or
K. McLENNAN & CO., Sole Manfrs., 300 Manhattan Bldg., Chicago, Ill.

FOR SALE

	Lights		Speed
2	450	Gen. Elec., type C, form T, direct-connected to Curtis form A non-condensing turbine, 100 lbs. pressure, 25 KW, 125 volt	3600
2	450	Gen. Elec., 6-pole, form L, 25 KW, direct-connected to Westinghouse vertical gasoline engines.	350
1	540	Gen. Elec., 6-pole, form F, comp., 30 KW, direct-connected to 11x8 in. Gen. Elec. vertical marine type engine, 125 volt	305
1	1300	Northern, MP, 75 KW, comp., direct-connected to Racine vertical cross comp. engine, 125 volt	275
1	1300	Westinghouse, 6-pole, comp., 75 KW, direct-connected to 14x14 Ames auto. center-crank horizontal engine, 125 volt	275

Send for our "Monthly Bargain Sheet" showing complete list of machines on hand with net prices. Every machine sold is completely overhauled and fully tested at our works before shipment, and is sent out practically "as good as new."

We Buy, Sell, Rent, Exchange and Repair

GREGORY ELECTRIC CO.
CHICAGO, ILLINOIS

Established 1893

THE AJAX HAIR DRYER

Makes hair drying a pleasure. Hot or cold air.

For the user, barber or hairdresser.
Retail price $15.00
Shoe Dryer (cold air only).
Retail price $12.50
Liberal discount to dealers and central stations.
Can be ordered through your central station, dealer, jobber or direct from us.

Write today for circular.

Central Telephone and Electric Co.
310 North Eleventh Street, St. Louis, Mo.

Thousands of Samples of Boiler Feed Waters come to us annually

for expert analysis—an evidence of the (1) world-wide prevalence of boiler troubles due to bad water supplies, (2) a universally unsatisfactory experience with "boiler compounds" of the blind "cure all" variety, and (3) a world-wide confidence in this institution among operators of power plants—in the integrity of its statements—and the recognized efficiency of

Scientific Dearborn Methods

in solving boiler water problems.
Why not avail yourself of this expert service?

Dearborn Chemical Co., McCormick Bldg., Chicago

Simplex Electric Irons

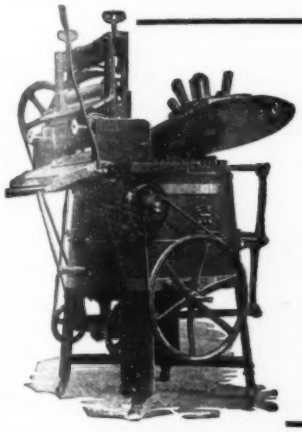
hold their supremacy because they satisfy everybody.

Unique in that the heater (covering the entire ironing surface) actually ***is the bottom*** of the iron.
Hence more and quicker heat for less current than any other iron of equal capacity. Throughout of Simplex Quality—efficiency with comfort to the user.

Do you know about ***the range*** that has revolutionized electric cooking?
Send for the new book: ***"It Means Freedom."*** It will help you.

Simplex Electric Heating Co.
Cambridge, Mass.
15 So. Desplaines St., Chicago
612 Howard St., San Francisco Belleville, Ont.

SIMPLEX QUALITY



Get Our
Prices Direct From Factory
To the Home

Not One Single Middleman's Profit Figured in Our 1913 Prices. Only ONE SMALL PROFIT Added to the Factory Cost.

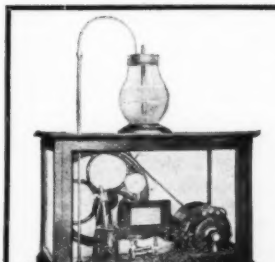
Electric Washers at Jobbers Prices

Less Than **$40.00** This Washer complete with 5 year guarantee, Reversible Wringer equipped with highest grade Electric motor ready to attach to any electric light socket. Warranted for five years.

Newton Washing Machine Co.
Newton, Iowa

Manufacturers of Electric Power and Hand Washing Machines. Send for Particulars and Catalog.

30 Days Free Trial



AGENTS WANTED to sell the Best Electric Best Pump on the market, the

Sanitary Cabinet Electric Pump

Absolutely automatic in operation, an ornament to the bar, delivering at all times a strong, uniform pressure of air filtered through water. No plumbing is necessary. For direct or alternating current. Belted motor drives air compressor.

Agents wanted everywhere for this ready, profitable seller. Write for territory today.

VARWIG MFG. CO., Sole Manufacturers
120 Opera Place, CINCINNATI, O.

Transmission Line Construction

Methods and Cost

By R. A. LUNDQUIST, E.E.

295 pp., 6 x 9, 183 illus. $3.00 (12/6) net, postpaid.

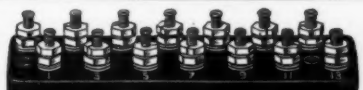
The best material—absolutely up-to-date—on every phase of transmission line construction. It is a book for the construction man, full of practical details.

These headings show how complete it is:

Some of the subjects covered are: Preliminary Work; Location of Line-Surveys and Engineering; Types of Construction; Wooden Pole Construction; Steel Pole Construction; Steel Tower Construction; Reinforced Concrete Construction, Special Structures; Cross-Arms; Hardware, Pins and Insulators, Guying; Stringing Wire; Cost Data of Typical Transmission Lines; Organization and Tools.

Electrical Review Publishing Company
Western Headquarters for Electrical Books
608 So. Dearborn St. Chicago, Ill.

Complete Stock of All Electrical Books on Hand



"INSULATE"

Endorsed by Leading Manufacturers and Engineers as ***the BEST*** composition for finish—strength—quality—price.

MANY STANDARD STYLES IN STOCK
Interconnections—Knobs—Bushings—Bases—Flanges

ANY ARTICLE IN COMPOSITION TO ORDER.

NEW "HI-HEET" MATERIAL.

Facilities Large—Deliveries Prompt

GENERAL INSULATE COMPANY
1018 Atlantic Ave., Brooklyn, N. Y.

ALPHABETICAL INDEX TO ADVERTISEMENTS

A

Allis-Chalmers Manufacturing Co. 2
American Bridge Co. 115
American Conduit Co. 11
American Conduit Mfg. Co. ..9, 163
American Cross Arm Co. 114
American District Steam Co. 124, 152
American Electrical Works..18, 163
American Sheet & Tin Plate Co. 115
American Steel & Wire Co. 17
American Telephone & Telegraph Co. 119
Anderson Mfg. Co., Albert & J. M. 80
Andrews, Ernest J. 124
Arnold Co. 124, 125
Atlantic Insulated Wire & Cable Co. 17
Atlantic Vehicle Co. 143

B

Babcock & Wilcox Co. 119
Badt-Westburg Electric Co. 115, 124
Bailey & Co., Inc., S. R. 142
Baker & Co., Inc. 160
Banner Elec. Wks. 52
Barnes & Kobert Mfg. Co. 39
Beardslee Chandelier Mfg. Co. 71
Bechtold, E. E. 74
Belden Manufacturing Co. 17
Benjamin Elec. Mfg. Co. 45
Blake Signal & Mfg. Co. 4
Bradley Timber & Railway Supply Co. 161
Brady Electric Mfg. Co. 160
Bridgeport Brass Co. 163
Bristol Co. 163
Bryan-Marsh Elec. Wks. 53, 59
Bryant Elec. Co. 32, 33
Buckeye Elec. Wks. 54, 55
Byllesby & Co., H. M. 124

C

Carney & Co., B. J. 161
Central Electric Co. 42, 43
Central Station Engineering Co. 124
Central Telephone & Elec. Co. .117
Century Electric Co. 94
Chelten Electric Co. 31
Chicago Electric Meter Co. 81
Chicago Fuse Mfg. Co. 27
Chicago Mica Co. 4
Cleveland Elec. Illuminating Co. 132
Clifton Mfg. Co. 8
Colonial Fan & Motor Co. 94
Columbia Incandescent Lamp Works 48
Commonwealth Edison Co. 4, 131, 150
Connecticut Electric Mfg. Co. . 30
Cooper Hewitt Elec. Co. 64
Crawford Cedar Co. 160
Crocker-Wheeler Co. 150
Cutler-Hammer Mfg. Co. 86, 87
Cutter Co. 144
Cutter Co., George. 69

D

D & W Fuse Co. 8
Daum Co., A. F. 28
Dearborn Chemical Co. 117
Detroit Insulated Wire Co. 163
Diamond Electric Co. 94
Diehl Mfg. Co. 95
Dixon Crucible Co., Joseph ...160
Dixon-Smith Engineering Co. .124
Dossert & Co. 91
Driver-Harris Wire Co. 16
Duluth Log Co 161
Duncan Electric Mfg. Co. 77

E

Eastern Electric Lamp Co. 60
Eck Dynamo & Motor Co. 150
Economical Electric Lamp Wks. 71
Economy Fuse & Mfg. Co. 29
Edison Elec. Illuminating Co. of Brooklyn 132
Edison Storage Battery Co. 137
Electrical Engineers Equipment Co. 3
Electrical Exposition & Motor Show of 1913. .....134, 135
Electrical Testing Laboratories.126
Electric Apparatus Co. 41
Electric Appliance Co. 75
Electric Bond & Share Co. 26
Electric Cable Co. 163
Electric City Sales Co. 74
Electric Controller & Mfg. Co.145
Electric Machinery Co. 155
Electric Shop 131
Electric Storage Battery Co. ..139
Electric Vehicle Association of America 141
Electrose Mfg. Co. 157
Emerson Electric Mfg. Co. 17

F

Flour City Ornamental Iron Works 67
Ford, Bacon & Davis. 124
Fort Wayne Electric Works... 76
Franklin Elec. Mfg. Co. 51, 57

G

General Electric Co. 107, 108, 109, 110, 111, 112, 113
General Insulate Co. 117
Gest, G. M. 12
Gill & Co., Inc. 71
Goodrich Co., B. F. 17
Gould Storage Battery Co. 138
Grand Ledge Clay Product Co. 8
Graner-Mahoney Contracting Co. 15
Gregory Electric Co. 117

H

Habirshaw Wire Co. 22
Hamilton-Beach Mfg. Co. ..98, 99, 100, 101, 102, 103, 104, 105
Hart Mfg. Co. 34
Hartford Time Switch Co. 83
Hazard Mfg. Co. 16
Help Wanted 116
Hemingray Glass Co. 156
Hemming Mfg. Co. 6
High Tension Electrical Specialty Co. 26
Hotel Sherman 96
Hoyt Electrical Instrument Works 78
Hubbard & Co. 36
Humphrey, C. W. 124

I

Illinois Electric Co. 93
Ilmenauer Glasinstrumenten Fabrik 119
Independent Electric Mfg. Co.. 3
Independent Lamp & Wire Co. 14
Indiana Rubber & Ins. Wire Co. 35, 114

J

Jackson, D. C., & Wm. B. 124
Jeandron, W. J. 146
Johns-Manville Co., H. W. 9
Jordan Bros., Inc. 8

K

Kellogg Switchboard & Supply Co. 17
Kerite Ins. Wire & Cable Co. 23, 163
Klein & Sons, Mathias. 38
Kliegl Bros. 62
Koerting & Mathiesen Co. 72

L

Laco-Phillips Co. 56
Leclanche Battery Co. 116
Le Valley Vitae Carbon Brush Co. 146
Linemen Protector Co. 40
Line Material Co. 37
Lindsley Bros. Co. 161
Lloyd-Thomas Co. 124
Lowell Insulated Wire Co. 16
Luminous Unit Co. 1
Lux Manufacturing Co. 50
Lyndon, Lamar 124

M

Manhattan Electrical Supply Co. 12
Marion Insulated Wire & Rubber Co. 163
McCandless & Co., H. W. 60
McDonnell Iron Wks. 68
McLennan Co., K. 116
McMeen, Samuel G. 124
Mechanical Appliance Co. 150
Menominee Elec. Mfg. Co. 94
Metropolitan Elec. Mfg. Co. 34
Meyers Mfg. Co., Fred J. 66
Mica Insulator Co. 4
Miller, Kempster B. 124
Minneapolis Elec. & Construction Co. 26
Miscellaneous 116
Mitchell-Rand Mfg. Co. 92
Moore, Alfred F. 16
Morgan Crucible Co., Ltd. 146
Morse Twist Drill & Machine Co. 152
Mott Iron Wks., J. L. 70
Myrlite Co. of America. 65

N

National Carbon Co. 66
National Conduit & Cable Co.. 16
National India Rubber Co. 17
National Metal Molding Co. ... 5
National Pole Co. 160
National Quality Lamp Division of General Elec. Co. 46, 47
Naugle Pole & Tie Co. 158
New England Butt Co. 16
New England Engineering Co. 124
Newgard & Co., Henry. 90
Newton Washing Machine Co. 117
New York Edison Co. 130
New York Insulated Wire Co. .163
Nungesser Carbon & Battery Co. 119

O

Okonite Co. 21, 114
Ornamental Lighting Pole Co. 66
Oshkosh Mfg. Co. 82
Ostrander & Co., W. R. 8

P

Packard Electric Co. 75, 88
Packard Lamp Wks. 49
Page & Hill Co. 160
Paiste Co., H. T. 31
Partridge Co., T. M. 158
Pass & Seymour, Inc. 7
Peerless Electric Co. 3, 146
Philadelphia Elec. Co. 129
Philadelphia Storage Battery Co. 136
Phillips Insulated Wire Co. 163
Phoenix Glass Co. 63
Pittsburgh Transformer Co. 89
Pillsbury, Charles L. 124, 126
Positions Wanted 116
P. R. Mfg. Co. 13
Prentiss Clock Improvement Co. 160
Pyrene Mfg. Co. 144

R

Rail, Frederick 64
Reisinger, Hugo 73
Reynolds Elec. Flasher Mfg. Co. 62
Richmond Electric Works. 150
Ridgway Dynamo & Engine Co. 150
Robbins & Myers Co. 149
Roebling's Sons Co., John A.. 16
Roller-Smith Co. 80
Rome Wire Co. 163
Rose Polytechnic Institute. 116
Roth Bros. & Co. 143

S

Safety Insulated Wire & Cable Co. 19
Samson Cordage Works. 119
Sandpoint Lumber & Pole Co., Ltd. 161
Sangamo Elec. Co. 79
Sargent & Lundy. 124, 126
Schott Co., W. H. 124
Schwarze Electric Co. 12
Siemens & Halske, A. G. 82
Siggers, E. G. 160
Simplex Electric Heating Co. .117
Simplex Wire & Cable Co. 25
Sprague Electric Works. 10
Standard Paint Co. 4
Standard Underground Cable Co. 25
States Co. 78
Steel City Electric Co. 7
Sterling & Son Co., W. C. 161
Stone & Webster Eng. Corp. ..124
Sundh Electric Co. 91

T

Thompson-Levering Co. 78
Torrey Cedar Co. 161
Triumph Electric Co. 151
Trumbull Electric Mfg. Co. 85
Tubular Woven Fabric Co. 13
Tungstolier Wks. of General Elec. Co. 61
Turner Improvement Co., J. W. 14
T.-W. Mfg. Co. 88

U

Underwriters' Laboratories, Inc. 124
Union Electric Co. 4
United Electric Light & Power Co. 128
U. S. Light & Heating Co. 26

V

Valentine-Clark Co. 159
Van Nostrand Co., D. 154
Varwig Mfg. Co. 117

W

Wagner Electric Mfg. Co. 153
Want Advertisements 116
Waterbury Co. 163
Western Electric Co. 97
Westinghouse Elec. & Mfg. Co. 162, 163
Westinghouse Lamp Co. 58
Westinghouse Machine Co. 147
Weston Elec. Instrument Co. ...114
White Companies, J. G. 124
Willard Storage Battery Co. ... 4
Wirt Elec. Specialty Co. 63
Woodmansee & Davidson, Inc. 124, 127
Wurdack Elec. Mfg. Co., Wm. 25

A Telephone Talk between an Electrical Manufacturer and a Jobber often proves the Opening Wedge for Profitable New Business.

AMERICAN TELEPHONE AND TELEGRAPH COMPANY
AND ASSOCIATED COMPANIES

One Policy *One System* *Universal Service*

THE BABCOCK & WILCOX COMPANY, 85 Liberty St., NEW YORK
BABCOCK & WILCOX, STIRLING, A. & T., HORIZONTAL, RUST
WATER TUBE STEAM BOILERS
Steam Superheaters — WORKS: BAYONNE, N. J., BARBERTON, OHIO. — Mechanical Stokers
BRANCH OFFICES
BOSTON, 35 Federal Street
PHILADELPHIA, North American Building
PITTSBURGH, Farmers' Deposit Bank Bldg.
SAN FRANCISCO, 99 First Street
NEW ORLEANS, Shubert Arcade
DENVER, 435 Seventeenth Street
SALT LAKE CITY, 313 Atlas Block
CHICAGO, Marquette Building
ATLANTA, GA., Candler Building
CLEVELAND, New England Building
CINCINNATI, O., Traction Building
PORTLAND, ORE., Wells-Fargo Building
SEATTLE, Mutual Life Building
HAVANA, CUBA, 116½ Calle de la Habana
LOS ANGELES, American Bank Building

Trade Mark Reg. U. S. Pat. Off.
SAMSON SPOT WATERPROOFED CORD FOR TROLLEYS AND ARC LAMPS
Send for Samples **SAMSON CORDAGE WORKS, Boston, Mass.**

MERCURY SWITCH TUBES
ILMENAUER GLASINSTRUMENTEN FABRIC
Alb. Zuckschwerdt
ILMENAU : : GERMANY

Card Index, ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, May 24, 1913. Vol. 62.

Leo H. Baekeland 1041
International Engineering Congress 1042
Railroad-Car Illumination 1042
Electricity in Packing Plants..... 1043
Power Economies in a Printing Plant..... 1048
Some Difficult Construction in an Electric Pumping Installation 1051
A Modern Installation of Hospital Wiring.—By Harold L. Alt 1053
Thirty Years Ago 1058
Production of the Diamond in the Electric Furnace.. 1063
Switchboard Equipment for the Parallel Operation of Alternators—By Arthur H. Ford 1064
The Electric Carbon Arc at Low Pressures..... 1065
Plans of Society for Electrical Development..... 1066
Grand Rapids Sewage Pumping 1067
The Sales Organization and Trade-Paper Advertising.—By William G. Campbell 1068
Efficiency Test of a Mill Supplied by Vertical Boilers.. 1069

Where long service is a consideration you will find the "1900" battery used.
The NUNGESSER CARBON & BATTERY CO., Cleveland, O.

CLASSIFIED INDEX OF ADVERTISERS

ADAPTERS, Lamp.
Benjamin Electric Mfg. Co.
Federal Sign System (Electric).
General Electric Co.

ADJUSTERS, Cord and Lamp.
McGill Mfg. Co.
Trumbull Electric Mfg. Co.
Vote-Berger Co.

AIR COMPRESSORS, Motor Driven.
Allis - Chalmers Manufacturing Co.
Emerson Electric Mfg. Co.
General Electric Co.

ALTERNATORS.
Allis - Chalmers Manufacturing Co.
Crocker-Wheeler Co.
Fort Wayne Electric Works.
General Electric Co.
Triumph Electric Co.
Westinghouse Electric & Mfg. Co.

AMMETERS AND VOLTMETERS.
Bristol Company.
General Electric Co.
Westinghouse Electric & Mfg. Co.
Weston Electrical Instrument Co.

ANCHORS, Guy.
Barnes & Kobert Mfg. Co.
Central Electric Co.
H. W. Johns-Manville Co.
Klein & Sons, Mathias.
Oshkosh Mfg. Co.
Vote-Berger Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

ANNUNCIATORS.
Central Electric Co.
Manhattan Electrical Supply Co.
Menominee Electric Mfg. Co.
W. R. Ostrander & Co.
Stanley & Patterson.
Western Electric Co.

ASBESTOS.
General Bakelite Co.
Johns-Manville Co., H. W.

ATTACHMENT PLUGS.
Benjamin Electric Mfg. Co.
Central Electric Co.
Cutler-Hammer Mfg. Co.
Federal Sign System (Electric).
General Electric Co.
Hart Mfg. Co.
H. W. Johns-Manville Co.
Manhattan Electrical Supply Co.
H. T. Paiste Co.
Pass & Seymour, Inc.
Simplex Electric Heating Co.
Trumbull Electric Mfg. Co.
Westinghouse Electric & Mfg. Co.
Wirt Electric Specialty Co.

AUTO STARTERS (For Starting A. C. Motors).
Allis - Chalmers Manufacturing Co.
Cutler-Hammer Mfg. Co.
Electric Controller & Mfg. Co.
General Electric Co.
Independent Electric Mfg. Co.
Triumph Electric Co.
Westinghouse Electric & Mfg. Co.
Western Electric Co.

AUTOMOBILES, Electric.
Atlantic Vehicle Co.
Bailey & Co., Inc., S. R.
General Vehicle Co.

AUTOMOBILE LIGHTING SYSTEMS.
General Electric Co.
Wagner Elec. Mfg. Co.
Westinghouse Electric & Mfg. Co.
Willard Storage Battery Co.

BASES AND SUB-BASES. Snap Switch.
Pass & Seymour, Inc.

BATTERIES, Dry.
Central Electric Co.
National Carbon Co.
Manhattan Electrical Supply Co.
Nungesser Carbon & Battery Co.
Stanley & Patterson.
Western Electric Co.

BATTERIES, Medical.
Manhattan Electrical Supply Co.
Menominee Electric Mfg. Co.
W. R. Ostrander & Co.
Stanley & Patterson.

BATTERIES, Storage.
Edison Storage Battery Co.
Gould Storage Battery Co.
Philadelphia Storage Battery Co.
United States Light & Heating Co.
Willard Storage Battery Co.

BATTERIES, Wet.
Central Electric Co.
Leclanche Battery Co.
Manhattan Electrical Supply Co.
National Carbon Co.

BATTERY CONNECTORS.
Belden Mfg. Co.

BATTERY HOLDERS.
National Carbon Co.
Stanley & Patterson.

BELL RINGING MOTORS.
Roth Bros. & Co.
Manhattan Electrical Supply Co.
W. R. Ostrander & Co.

BELLS, Electric.
Central Electric Co.
Menominee Electric Mfg. Co.
P. R. Mfg. Co.
Schwarze Electric Co.
Stanley & Patterson.
Western Electric Co.

BELT DRESSINGS.
Joseph Dixon Crucible Co.

BELT FASTENERS.
Bristol Co.

BENDERS, Conduit and Pipe.
Thomas & Betts Co.
Western Electric Co.

BINDING POSTS.
Bridgeport Brass Co.
Manhattan Electrical Supply Co.
Menominee Electric Mfg. Co.
Stanley & Patterson.
Western Electric Co.

BLOCKS, Meter Testing.
Hart Mfg. Co.

BLOWERS AND EXHAUSTERS.
Emerson Electric Mfg. Co.
General Electric Co.
Mechanical Appliance Co.
Roth Bros. & Co.
Sprague Electric Co.

BLOWERS, Organ.
Crocker-Wheeler Co.
Diehl Mfg. Co.
Emerson Electric Mfg. Co.
Roth Bros. & Co.

BOILERS, Steam.
Babcock & Wilcox Co.

BONDS, SHARES AND SECURITIES.
Electric Bond & Share Co.

BOOKS, Technical.
Electrical Review Pub. Co.
Van Nostrand Co., D.

BOOSTERS.
Allis - Chalmers Manufacturing Co.
Crocker-Wheeler Co.
General Electric Co.
Ridgway Dynamo & Engine Co.
Westinghouse Electric & Mfg. Co.

BOXES, Conduit.
Adapti Mfg. Co.
Appleton Electric Co.
Benjamin Electric Mfg. Co.
Central Electric Co.
Chicago Fuse Mfg. Co.
Columbia Metal Box Co.
Cutter Co.
Cutler Co., George.
Federal Sign System (Electric).
Hamilton Sheet Metal Co.
Hart Mfg. Co.
J. Gordon Knight Electric Co., Inc.
W. R. Ostrander & Co.
H. T. Paiste Co.
Pass & Seymour, Inc.
Sprague Electric Works.
Thomas & Betts Co.

BOXES, Floor.
Frank Adam Electric Co.
Central Electric Co.
General Electric Co.
Manhattan Electrical Supply Co.
Stanley & Patterson.
Thomas & Betts Co.

BOXES, Manhole.
Columbia Metal Box Co.
D & W Fuse Co.
General Electric Co.
H. W. Johns-Manville Co.
Standard Underground Cable Co.

BOXES, Service, Sheet Steel and Cast Iron Entrance Boxes and Panelboard Cabinets.
Frank Adam Electric Co.
Adapti Mfg. Co.
F. Bissell Co.
T. H. Brady.
Columbia Metal Box Co.
Cutter Co., George.
Electric Apparatus Co.
Federal Sign System (Electric).
General Electric Co.
Hamilton Sheet Metal Co.
H. W. Johns-Manville Co.
H. T. Paiste Co.
Trumbull Electric Mfg. Co.
Standard Underground Cable Co.
Westinghouse Electric & Mfg. Co.
Wm. Wurdack Elec. Mfg. Co.

BRACES, Cross Arm.
F. Bissell Co.

BRACKETS, ARMS AND PINS, (Iron).
Albert & J. M. Anderson Mfg. Co.
Brady Electric Mfg. Co.
Electrical Engineers' Equipment Co.
Hubbard & Co.

BRACKETS, Pothead.
F. Bissell Co.
Electrical Engineers' Equipment Co.

BRAKES, Motor.
Electric Controller & Mfg. Co.
Westinghouse Electric & Mfg. Co.

BRAKES, Dynamo.
Cutler-Hammer Mfg. Co.
Independent Electric Mfg. Co.

BRAKES, Electric.
Cutler-Hammer Mfg. Co.
Electric Controller & Mfg. Co.
General Electric Co.
Independent Electric Mfg. Co.
Sundh Electric Co.
Western Electric Co.

BRASS AND COPPER.
Bridgeport Brass Co.

BRIDGES.
American Bridge Co.

BRUSHES, Carbon and Graphite.
Central Electric Co.
Chapin Co., Inc., Chas. E.
Joseph Dixon Crucible Co.
General Electric Co.
Holmes Fibre Graphite Mfg. Co.
Jeandron, W. J.
Le Valley-Vitae Carbon Brush Co.
Morgan Crucible Co., Ltd.
National Carbon Co.
Nungesser Carbon & Battery Co.
Hugo Reisinger.
Triumph Electric Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

BRUSHES, Metallic.
Cutler-Hammer Mfg. Co.
General Electric Co.
Triumph Electric Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

BUFFERS, Motor Driven.
Hamilton-Beach Co.

BURGLAR ALARMS.
Manhattan Electrical Supply Co.
W. R. Ostrander & Co.
Stanley & Patterson.

BUS BAR SUPPORTS.
Electrical Engineers' Equipment Co.

BUSHINGS AND LOCKNUTS. (For Conduit.)
A. & J. M. Anderson Mfg. Co.
Appleton Electric Co.
Federal Sign System (Electric).
General Electric Co.
New Process Specialty Co., Inc.
Sprague Electric Works.
Thomas & Betts Co.

BUSHINGS, Porcelain Clamping.
Federal Sign System (Electric).
General Electric Co.
Pass & Seymour, Inc.

BUSHINGS, Socket.
General Insulate Co.
Hemming Mfg. Co.
Massachusetts Chemical Co.
Western Electric Co.

CABLES.
American Electrical Works.
American Steel & Wire Co.
American Insulated Wire & Cable Co.
Atlantic Insulated Wire & Cable Co.
Belden Mfg. Co.
Brixey, W. R.
Central Electric Co.
Electric Cable Co.
General Electric Co.
Habirshaw Wire Co.
Hazard Mfg. Co.
Kerite Insulated Wire & Cable Co.
Moore, Alfred F.
National Conduit & Cable Co.
Okonite Co.
Roebling's Sons Co., John A.
Safety Insulated Wire & Cable Co.
Simplex Wire & Cable Co.
Standard Underground Cable Co.
Waterbury Co.
Western Electric Co.

CABLE BELLS.
Electrical Engineers' Equipment Co.

CABLE HANGERS.
A. & J. M. Anderson Mfg. Co.
Appleton Electric Co.
F. Bissell Co.
Mineralac Electric Co.
Standard Underground Cable Co.
Western Electric Co.

CABLE RACKS.
General Electric Co.
Standard Underground Cable Co.

CABLE TERMINALS.
Standard Underground Cable Co.

CABLE TESTERS.
Mineralac Electric Co.
Standard Underground Cable Co.

CABLES, Armored. (Flexible.)
Sprague Electric Works.
Standard Underground Cable Co.

CABLING MACHINES.
New England Butt Co.

CALIBRATORS, Meter.
Fort Wayne Electric Works.
General Electric Co.

CANOPY INSULATORS.
Bechtold, E. E.
General Electric Co.
Mica Insulator Co.

CARBONS, Arc Light.
Central Electric Co.
General Electric Co.
Koerting & Mathiesen.
National Carbon Co.
Hugo Reisinger.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

CARBONS, Battery.
Manhattan Electrical Supply Co.
National Carbon Co.

CAR HEATING, Electric.
Johns-Manville Co., H. W.
Simplex Electric Heating Co.
Western Electric Co.

CAR LIGHTING SYSTEMS.
Gould Storage Battery Co.
United States Light & Heating Co.

CASTINGS.
Albert & J. M. Anderson Mfg. Co.
Faries Mfg. Co.
New England Butt Co.
Triumph Electric Co.

CEMENT MACHINERY.
Allis - Chalmers Manufacturing Co.

CHANDELIERS.
Beardslee Chandelier Mfg. Co.
Central Electric Co.

CHANGERS, Inc. Lamp.
McGill Mfg. Co.

CHARGING OUTFITS.
Crocker-Wheeler Co.
Cutler-Hammer Mfg. Co.
General Electric Co.

CHOKE COILS.
Albert & J. M. Anderson Mfg. Co.
General Electric Co.
Westinghouse Electric & Mfg. Co.

CIGAR LIGHTERS.
General Electric Co.
Simplex Electric Heating Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

CIRCUIT BREAKERS, Automatic.
Cutler-Hammer Mfg. Co.
Cutter Co.
Fort Wayne Electric Works.
General Electric Co.
Independent Electric Mfg. Co.
Sundh Electric Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

CLAMPS, Cable Supporting.
Electrical Engineers' Equipment Co.

CLAMPS, Flexible Tubing.
New Process Specialty Co., Inc.
T. W. Manufacturing Co.

CLAMPS, Insulator.
Electrical Engineers' Equipment Co.

CLASSIFIED INDEX—Continued

CLEANERS, Glass.
Myrilite Co. of America.

CLEATS, Fibre.
Blake Signal & Mfg. Co.
General Electric Co.

CLEATS, Insulating.
Hemming Mfg. Co.
Mineralac Electric Co.

CLIMBERS, Linemen's.
Klein & Sons, Mathias.
Western Electric Co.

CLOTH, Insulating.
Mica Insulator Co.
Packard Electric Co.

CLUSTERS.
Benjamin Electric Mfg. Co.
Central Electric Co.
Federal Sign System (Electric).
McGill Mfg. Co.
Western Electric Co.

COAL MINING MACHINERY.
Allis - Chalmers Manufacturing Co.
General Electric Co.
Westinghouse Electric & Mfg. Co.

COILS.
American Electrical Works.
Belden Mfg. Co.
D & W Fuse Co.
General Electric Co.
Independent Lamp & Wire Co.
Kellogg Switchboard & Supply Co.
Manhattan Electrical Supply Co.
Menominee Electric Mfg. Co.
W. R. Ostrander & Co.
Stanley & Patterson.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.

COMMUTATOR LUBRICANTS.
Joseph Dixon Crucible Co.
McGill Mfg. Co.
K. McLennan & Co.

COMMUTATOR TRUING DEVICES.
Jordan Bros.

COMPOUNDS, Boiler Cleansing.
Dearborn Chemical Co.
H. W. Johns-Manville Co.

CONDENSERS, Electric.
Leeds & Northrup Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

CONDENSERS, Steam.
Allis - Chalmers Manufacturing Co.
Westinghouse Mach. Co.

CONDUIT.
American Conduit Co.
American Conduit Mfg. Co.
Central Electric Co.
Clifton Mfg. Co.
Sprague Electric Works.
Tubular Woven Fabric Co.

CONDUIT RODS.
F. Bissell Co.
Standard Underground Cable Co.
Western Electric Co.

CONDUIT, Underground. Clay, Composition, Wood.
American Conduit Co.
American Cross Arm Co.
H. B. Camp Co.
Grand Ledge Clay Products Co.
H. W. Johns-Manville Co.
McRoy Clay Works.

CONDUIT ENGINEERS & CONTRACTORS.
G. M. Gest.
Graner-Mahoney Contracting Co.
Standard Paint Co.
Standard Underground Cable Co.
Westinghouse Electric & Mfg. Co.
J. W. Turner Improvement Co.

CONNECTORS.
Dossert & Co.

CONSTRUCTION, Engineering.
Arnold Co.
Byllesby & Co., H. M.
Central Station Engineering Co.
Electrical Engineers' Equipment Co.
New England Engineering Co.
Stone & Webster Eng. Corp.
White & Co., J. G.

CONTROLLERS, Printing Press.
Allis - Chalmers Manufacturing Co.
Crocker-Wheeler Co.
Cutler-Hammer Mfg. Co.
Electric Controller & Mfg. Co.
General Electric Co.
Independent Electric Mfg. Co.
Westinghouse Electric & Mfg. Co.

COOKING DEVICES, Electric.
Cutler-Hammer Mfg. Co.
Federal Sign System (Electric).
General Electric Co.
Manhattan Electrical Supply Co.
Simplex Electric Heating Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

COPPERS, Battery.
Manhattan Electrical Supply Co.
Stanley & Patterson.
Western Electric Co.

CORD, Braided.
Samson Cordage Works.

CRANES AND HOISTS.
Allis - Chalmers Manufacturing Co.
Jordan Bros.
Sprague Electric Works.

CRANE MOTORS.
Crocker-Wheeler Co.
Ft. Wayne Electric Works.
General Electric Co.
Triumph Electric Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

CROSS ARMS (Wood).
American Cross Arm Co.
F. Bissell Co.
Lindsley Brothers Co.

CURLING IRONS, Electric.
Simplex Electric Heating Co.

CUT-OUTS. Enclosed Fuse, Plug, Combination Rosette, Cut-Out Bases.
Central Electric Co.
Chicago Fuse Mfg. Co.
Commonwealth Edison Co.
D & W Fuse Co.
Detroit Fuse & Mfg. Co.
General Electric Co.
Hart Mfg. Co.
H. W. Johns-Manville Co.
Jordan Bros., Inc.
Manhattan Electrical Supply Co.
H. T. Paiste Co.
Pass & Seymour, Inc.
Trumbull Elec. Mfg. Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

CUT-OUTS, Arc Light.
Brady Electric Mfg. Co.
Fort Wayne Electric Works.
General Electric Co.

CUT-OUTS, Transformer.
Central Electric Co.
D & W Fuse Co.
General Electric Co.
Pass & Seymour, Inc.
Westinghouse Electric & Mfg. Co.

DECORATIVE LIGHTING.
Central Electric Co.
General Electric Co.
Manhattan Electrical Supply Co.

DIRECT MOTOR DRIVES.
Crocker-Wheeler Co.
Electric Controller & Mfg. Co.
General Electric Co.
Triumph Electric Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

DOOR SWITCHES.
Cutler-Hammer Mfg. Co.
Cutter Co.
Hart Mfg. Co.

DRILLS AND BITS, Electricians'.
Daugherty-Smith-Phillips Co.
Morse Twist Drill & Machine Co.

DRINK MIXERS, Motor Driven.
Hamilton-Beach Co.

ELECTRIC VEHICLES.
Atlantic Vehicle Co.
Bailey & Co., Inc., S. R.
General Vehicle Co.

ELECTRODES, Furnace.
National Carbon Co.

ELECTRO - PLATING MACHINERY.
Crocker-Wheeler Co.
Ft. Wayne Electric Works.
General Electric Co.
Roth Bros. & Co.
Sprague Electric Works.
Westinghouse Electric & Mfg. Co.

ENGINEERS & CONTRACTORS.
American Bridge Co.
Arnold Co.
Badt-Westburg Electric Co.
H. M. Byllesby & Co.
Central Station Engineering Co.
Dixon-Smith Engineering Co.
Electrical Engineers' Equipment Co.
Ford, Bacon & Davis.
C. W. Humphrey.
D. C. & W. B. Jackson.
Kohler Bros.
Lamar Lyndon.
Lloyd-Thomas Co.
McMeen & Miller.
New England Engineering Co.
Chas. A. Pillsbury.
Sargent & Lundy.
Stone & Webster Engineering Corporation.
J. W. Turner Improvement Co.
Western Electric Co.
J. G. White Companies.
Woodmansee & Davidson, Inc.

ENGINES, Gas and Gasoline.
Allis - Chalmers Manufacturing Co.
Westinghouse Machine Co.

ENGINES, Steam.
Allis - Chalmers Manufacturing Co.
Ridgway Dynamo & Engine Co.
Westinghouse Machine Co.

EXTINGUISHERS, Fire.
H. W. Johns-Manville Co.
Pyrene Mfg. Co.

FANS, Motor and Disc.
Central Electric Co.
Century Electric Co.
Colonial Fan & Motor Co.
Crocker-Wheeler Co.
Diehl Mfg. Co.
Emerson Electric Mfg. Co.
Fort Wayne Electric Works.
General Electric Co.
Hamilton-Beach Co.
Manhattan Electrical Supply Co.
Menominee Electric Mfg. Co.
Peerless Electric Co.
Robbins & Myers Co.
Sprague Electric Works.
Wagner Elec. Mfg. Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

FAULT FINDERS, Electric.
Electric Controller & Mfg. Co.

FIREPLACES, Electric.
General Electric Co.
Westinghouse Electric & Mfg. Co.

FITTINGS, Conduit Terminals, Bushings, Entrance Caps.
Appleton Electric Co.
National Metal Molding Co.
H. T. Paiste Co.
Sprague Electric Works.

FIXTURES, Electric and Gas.
Frank Adam Elec. Co.
Beardslee Chandelier Mfg. Co.
Benjamin Electric Mfg. Co.
Central Electric Co.
Federal Sign System (Electric).
Tungstolier Works of General Electric Co.
Western Electric Co.
Western Lamp & Brass Works.

FIXTURES, Indirect Lighting.
Central Electric Co.
Federal Sign System (Electric).

FIXTURES, Show Case.
Benjamin Electric Mfg. Co.
Central Electric Co.
H. W. Johns-Manville Co.

FLASHERS, Sign.
F. Bissell Co.
Reynolds Electric Flasher Mfg. Co.

FLAT IRONS, Electric.
Central Electric Co.
Cutler-Hammer Mfg. Co.
Diamond Electric Co.
General Electric Co.
Manhattan Electrical Supply Co.
Simplex Electric Heating Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

FLUXES, Soldering.
Blake Signal & Mfg. Co.
Burnley Battery & Mfg. Co.
Chicago Fuse Mfg. Co.
H. W. Johns-Manville Co.
McGill Mfg. Co.
Manhattan Electrical Supply Co.
Western Electric Co.

FURNACES, Electric.
Siemens & Halske, A. G.

FUSE PLUGS.
Albert & J. M. Anderson Mfg. Co.
D & W Fuse Co.
General Electric Co.
H. W. Johns-Manville Co.
Stanley & Patterson.
Westinghouse Elec. & Mfg. Co.
Western Electric Co.

FUSE WIRE.
Appleton Electric Co.
General Electric Co.
Western Electric Co.

FUSES.
Central Electric Co.
Chicago Fuse Mfg. Co.
D & W Fuse Mfg. Co.
Daum Co., E. F.
Detroit Fuse & Mfg. Co.
Economy Fuse & Mfg. Co.
General Electric Co.
Johns-Manville Co., H. W.
Westinghouse Electric & Mfg. Co.

GEARS, Rawhide and Composition.
General Electric Co.
New Process Raw Hide Co.

GENERATORS.
Allis - Chalmers Manufacturing Co.
Crocker-Wheeler Co.
Eck Dynamo & Motor Co.
Fort Wayne Electric Works.
General Electric Co.
Ridgway Dynamo & Engine Co.
Triumph Electric Co.
Westinghouse Electric Mfg. Co.

GLASSWARE, Illuminating.
Central Electric Co.
Holophane Works of General Electric Co.
Jefferson Glass Co.
Phoenix Glass Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

GLOBES, Arc Light. (Outer and Inner.)
General Electric Co.
Holophane Works of General Electric Co.
Phoenix Glass Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

GRAPHITE.
Joseph Dixon Crucible Co.
Holmes Fibre-Graphite Mfg. Co.

GRINDERS.
Hamilton-Beach Co.

GROUND CLAMPS.
Blackburn Specialty Co.
Federal Sign System (Electric).
General Electric Co.
Hart Mfg. Co.
Mineralac Electric Co.
H. T. Paiste Co.
Sprague Electric Works.
Thomas & Betts Co.
Western Electric Co.

GROUNDING DEVICES.
Federal Sign System (Electric).

GUARDS, Inc. Lamp.
Benjamin Electric Mfg. Co.
McGill Mfg. Co.
Sorensen, P.

GUY CLAMPS.
American Steel & Wire Co.
Barnes & Kobert Mfg. Co.

HAIR DRYERS, Electric.
Central Telephone & Elect. Co.
Hamilton-Beach Co.

HANGERS, Conduit and Moulding.
Mineralac Electric Co.
Western Electric Co.

HANGERS AND CLAMPS.
F. Bissell Co.
Mineralac Electric Co.
W. R. Ostrander & Co.
Pass & Seymour, Inc.
Sprague Electric Co.
Standard Underground Cable Co.
Thomas & Betts Co.

HEATERS, Electric.
Cutler-Hammer Mfg. Co.
General Electric Co.
Simplex Electric Heating Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

HEATING SYSTEMS, Exhaust Steam.
American District Steam Co.

HOISTING MACHINERY, Electric Mine.
Allis - Chalmers Manufacturing Co.
General Electric Co.

HOSE, Rubber.
B. F. Goodrich Co.

HOUSES, Pole or Pilot.
F. Bissell Co.

HYDRAULIC MACHINERY.
Allis - Chalmers Manufacturing Co.

INSTRUMENTS.
Bristol Co.
Electric Controller & Mfg. Co.
Fort Wayne Electric Works.
General Electric Co.
Holcomb & Hoke Mfg. Co.
Hoyt Electrical Instrument Co.
H. W. Johns-Manville Co.
Leeds & Northrup Co.
Manhattan Electrical Supply Co.
Mineralac Electric Co.
Roller Smith Co.
Thompson-Levering Co.
Wagner Elec. Mfg. Co.
Westinghouse Electric & Mfg. Co.
Weston Electrical Instrument Co.

CLASSIFIED INDEX—Continued

INSULATING CEMENTS.
Westinghouse Electric & Mfg. Co.

INSULATING MACHINERY.
New England Butt Co.

INSULATING PAINTS AND COMPOUNDS.
H. W. Johns-Manville Co.
McGill Mfg. Co.
Massachusetts Chemical Co.
Mica Insulator Co.
Mineralac Electric Co.
Sherwin-Williams Co.
Standard Paint Co.
Standard Underground Cable Co.
Westinghouse Electric & Mfg. Co.

INSULATION, Hard Rubber Composition, Etc.
Diamond Rubber Co.
General Bakelite Co.
General Insulate Co.
Hemming Mfg. Co.
Scranton Button Co.
Westinghouse Electric & Mfg. Co.

INSULATORS, Arc Lamp.
Albert & J. M. Anderson Mfg. Co.
General Electric Co.
H. W. Johns-Manville Co.
Westinghouse Electric & Mfg. Co.

INSULATORS, Glass.
Brookfield Glass Co.
General Electric Co.
Hemingray Glass Co.
High Tension Electrical Specialty Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

INSULATORS, High Voltage.
Electrical Engineers' Equipment Co.
Electrose Mfg. Co.
Fairmont Electric & Mfg. Co.
General Electric Co.
High Tension Electrical Specialty Co.
H. W. Johns-Manville Co.
Westinghouse Electric & Mfg. Co.

INSULATORS, Wood.
Mineralac Electric Co.
Westinghouse Electric & Mfg. Co.

IRIDIO-PLATINUM.
Baker & Co.

JARS, Battery (Glass).
Brookfield Glass Co.
Hemingray Glass Co.

JOINTS, Cable.
Dossert & Co.
General Electric Co.

JOINTS, Fixture Insulating.
Federal Sign System (Electric).
Thomas & Betts Co.

KITCHEN CABINETS.
Federal Sign System (Electric).

LABORATORY EQUIPMENT.
States Co.

LACQUER, Metal.
General Bakelite Co.

LAMPS, Arc.
Albert & J. M. Anderson Mfg. Co.
Central Electric Co.
Fort Wayne Electric Works.
General Electric Co.
Koerting & Mathiesen.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

LAMP REGULATORS.
Any Lite Inc. Lamp Regulator Co.

LAMPS, Incandescent Miniature, Carbon Filament, Metal Filament.
Aetna Lamp Co.
General Electric Co.
W. H. McCandless & Co.
Packard Lamp Wks. of General Electric Co.

LAMPS, Incandescent.
Aetna Lamp Co.
Central Electric Co.
Eastern Electric Lamp Co.
Franklin Electric Mfg. Co.
National Quality Lamp Division of General Electric Company, comprising the following member works:
American Electric Lamp Wks.
Banner Electric Works.
Boston Incandescent Lamp Works.
Brilliant Electric Works.
Bryan-Marsh Electric Works
Buckeye Electric Works.
Colonial Electric Works.
Columbia Incandescent Lamp Works.
Economical Electric Lamp Works.
Economy Electric Works.
Elux Miniature Lamps Works.
Federal Miniature Lamp Wks.
Fostoria Incandescent Lamp Works.
General Incandescent Lamp Works.
Monarch Incandescent Lamp Works.
Munder Electric Works.
Packard Lamp Works.
Peerless Lamp Works.
Shelby Lamp Works.
Standard Electric Works.
Sterling Electric Lamp Works.
Sunbeam Incandescent Lamp Works.
Independent Lamp & Wire Co.
H. W. Johns-Manville Co.
Laco-Phillips Co.
Lux Mfg. Co.
New York Incandescent Lamp Co.
Union Light & Supply Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.
Westinghouse Lamp Co.

LAMPS, Vapor and Vacuum Tube.
Cooper Hewitt Electric Co.
General Electric Co.

LIGHTING PLANTS.
Crocker-Wheeler Co.
General Electric Co.
Westinghouse Electric & Mfg. Co.

LIGHTNING ARRESTERS.
Albert & J. M. Anderson Mfg. Co.
Central Electric Co.
General Electric Co.

LIGHTS, Desk.
Federal Sign System (Electric).
Johns-Manville Co., H. W.
Stanley & Patterson.

LIGHTS, Stage.
F. Bissell Co.
Universal Elec. Stage Lighting Co.

LINE MATERIALS.
Albert & J. M. Anderson Mfg. Co.
Central Electric Co.
General Electric Co.
Hubbard & Co.
H. W. Johns-Manville Co.
Line Material Co.
Linemen Protector Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

LOCOMOTIVES, Electric.
General Electric Co.
Westinghouse Electric & Mfg. Co.

LUBRICANTS.
Dearborn Chemical Co.
Joseph Dixon Crucible Co.

LUGS.
Chicago Fuse Mfg. Co.
Electrical Engineers Equipment Co.
Trumbull Electric Mfg. Co.

MACHINE TOOLS.
Allis-Chalmers Manufacturing Co.

MAGNETIC SWITCH CONTROLLERS.
Cutler-Hammer Mfg. Co.
Electric Controller & Mfg. Co.
General Electric Co.
Independent Electric Mfg. Co.
Sundh Electric Co.

MAGNETOS, MAGNETO-GENERATORS AND BELLS.
Manhattan Electrical Supply Co.
Menominee Electric Mfg. Co.
Western Electric Co.

MAGNETOS, Ignition.
General Electric Co.
Manhattan Electrical Supply Co.

MAGNETS, Electro.
Automatic Electric Co.
Bejden Mfg. Co.
Cutler-Hammer Mfg. Co.
Electric Controller & Mfg. Co.
General Electric Co.
Independent Electric Mfg. Co.
Manhattan Electrical Supply Co.
Sundh Electric Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

MAGNETS, Lifting.
Cutler-Hammer Mfg. Co.
Electric Controller & Mfg. Co.
Independent Electric Mfg. Co.
Sundh Electric Co.
Western Electric Co.

MAGNETS, Permanent.
Automatic Electric Co.
Western Electric Co.

MARINE FIXTURES.
Benjamin Electric Mfg. Co.
General Electric Co.

MAST ARMS.
Brady Electric Mfg. Co.
Fort Wayne Electric Works.
Pittsburgh Transformer Co.

MEASURING MACHINES (For Wire Measuring).
Minneapolis Electric & Construction Co.
New England Butt Co.

METERS, Recording.
Bristol Co.
Chicago Electric Meter Co.
General Electric Co.

MICA.
Chicago Mica Co.
Mica Insulator Co.
Eugene Munsell & Co.

MINING MACHINERY (Motor Driven).
Allis-Chalmers Manufacturing Co.
General Electric Co.
Westinghouse Electric & Mfg. Co.

MOTORS AND DYNAMOS.
Allis-Chalmers Manufacturing Co.
Central Electric Co.
Century Electric Co.
Colonial Fan & Motor Co.
Crocker-Wheeler Co.
Diehl Mfg. Co.
Eck Dynamo & Motor Co.
Emerson Electric Mfg. Co.
Ft. Wayne Electric Works.
General Electric Co.
Hamilton-Beach Co.
Mechanical Appliance Co.
Peerless Electric Co.
Richmond Electric Works.
Ridgway Dynamo & Engine Co.
Robbins & Myers Co.
Roth Bros. & Co.
Sprague Electric Works.
Triumph Electric Co.
Wagner Electric Mfg. Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

MOULDING.
National Metal Molding Co.
H. T. Paiste Co.
Stanley & Patterson.
Trumbull Electric Mfg. Co.

OZONIZERS.
Federal Sign System (Electric).
General Electric Co.

PACKING, Steam.
B. F. Goodrich Co.
H. W. Johns-Manville Co.
New York Insulated Wire Co.

PAINTS, Preservative.
Joseph Dixon Crucible Co.
H. W. Johns-Manville Co.
Standard Paint Co.
Western Electric Co.

PATENT SOLICITORS.
Edw. S. Duvall.
Siggers & Siggers.

PHOTOMETERS, Lamp Testing.
Leeds & Northup Co.

PHOTOMETER STANDARDS.
Electrical Testing Laboratories.

PIGTAILS AND FLEXIBLE LEADS.
Belden Mfg. Co.
Rome Wire Co.

PINS AND BRACKETS, Wood.
American Cross-Arm Co.
F. Bissell Co.
Electrical Engineers Equipment Co.

PIPE COVERINGS, STEAM.
American District Steam Co.
H. W. Johns-Manville Co.

PLATFORMS (Pole Seats).
F. Bissell Co.

PLATINUM.
American Platinum Works.
Baker & Co., Inc.

PLIERS, Wire Cutting.
H. W. Johns-Manville Co.
Mathias Klein & Sons.

PLUGS AND RECEPTACLES, Flush.
General Electric Co.
Hart Mfg. Co.
Manhattan Electrical Supply Co.
H. T. Paiste Co.
Trumbull Electric Mfg. Co.

PLUGS AND RECEPTACLES, Stage.
Frank Adam Electric Co.
General Electric Co.
Manhattan Electrical Supply Co.
Stanley & Patterson.
Universal Electric Stage Lighting Co.
Western Electric Co.

POLES, Concrete.
American Steel & Wire Co.

POLES, Treated.
Lindsley Bros. & Co.
Page & Hill Co.
Valentine-Clark Co.

POLES, Wood.
F. Bissell Co.
Carney & Co., B. J.
Crawford Cedar Co.
Deal Lumber Co., L. K.
Duluth Log Co.
Lindsley Bros. Co.
National Pole Co.
Naugle Pole & Tie Co.
Page & Hill Co.
Partridge Lumber Co., T. M.
Sandpoint Lumber & Pole Co., Ltd.
Sterling & Son Co., W. C.
Torrey Cedar Co.
Valentine-Clark Co.
Western Electric Co.

POLE CHANGERS.
Kellogg Switchboard & Supply Co.

POLE STEPS.
American Steel & Wire Co.
Albert & J. M. Anderson Mfg. Co.

PORCELAIN, Special Shapes.
Findlay Electric Porcelain Co.
Pass & Seymour, Inc.

PORCELAIN, Standard.
Cook Pottery Co.
General Electric Co.
Pass & Seymour, Inc.

PORTABLES, Electric Reading Lamps.
Franks Mfg. Co.
H. W. Johns-Manville Co.
Phoenix Glass Co.
Western Lamp & Brass Works.

POSTS, Lamp.
Central Electric Co.
Cutter Co., George.
Fleur City Ornamental Iron Works.
King Foundry Co.
J. L. Mott Iron Works.
McDonnell Iron Works.
Meyers Mfg. Co., Fred. J.
Ornamental Lighting Pole Co.

POTENTIOMETERS.
Leeds & Northrup Co.

POTHEADS AND SLEEVES.
F. Bissell Co.
Brady Electric Mfg. Co.
Central Electric Co.
Electrical Engineers' Equipment Co.
General Electric Co.
Mineralac Electric Co.
Okonite Co.
Standard Underground Cable Co.

PRESERVATIVES, Wood.
Carbolineum Wood Preserving Co.
General Bakelite Co.
Lindsley Brothers Co.

PRINTING ATTACHMENTS FOR METERS.
Mineralac Electric Co.

PRODUCERS, Gas.
Allis-Chalmers Manufacturing Co.
Westinghouse Machine Co.

PROJECTORS, Electric. (Search Lights.)
Fort Wayne Electric Works.
General Electric Co.

PROJECTORS, Telephone.
D & W Fuse Co.

PYROMETERS, Electric.
Bristol Co.
Leeds & Northrup Co.

PULLEYS, Arc Lamp.
Fort Wayne Elec. Works.

PUMPS, BEER.
Varwig Mfg. Co.

PUMPS, Water.
Allis-Chalmers Manufacturing Co.
Fort Wayne Engineering & Mfg. Co.

PUSH BUTTONS.
Central Electric Co.
Cutler-Hammer Mfg. Co.
Manhattan Electrical Supply Co.
Pass & Seymour, Inc.
Western Electric Co.

RACKS AND RINGS, Telephone Distributing.
F. Bissell Co.

RADIATORS, Luminous.
General Electric Co.

RAIL BONDS.
General Electric Co.
H. W. Johns-Manville Co.
Rail Joint Co.
John A. Roeblings Sons Co.
Western Electric Co.

RAIL JOINTS.
Rail Joint Co.
Western Electric Co.

CLASSIFIED INDEX—Continued

RAILWAY SPECIALTIES, Electric.
Albert & J. M. Anderson Mfg. Co.
Blake Signal & Mfg. Co.
General Electric Co.
H. W. Johns-Manville Co.
Rail Joint Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

RECEPTACLES, Sign.
Benjamin Electric Mfg. Co.
Federal Sign System (Electric).
General Electric Co.
H. T. Paiste Co.
Pass & Seymour, Inc.
Stanley & Patterson.

RECEPTACLES, Weatherproof.
Federal Sign System (Electric).
General Electric Co.
H. T. Paiste Co.
Pass & Seymour, Inc.
Stanley & Patterson.

RECORDERS, Time.
Bristol Company.
Calculagraph Co.

RECTIFIERS.
General Electric Co.
Wagner Elec. Mfg. Co.
Westinghouse Electric & Mfg. Co.

REELS, Wire.
Mathias Klein & Sons.
Minneapolis Elec. & Const. Co.

REFLECTORS, Mirror.
Holophane Works of General Electric Co.

REPAIRS, Armature.
Commonwealth Edison Co.
Waterbury Co.
Westinghouse Electric & Mfg. Co.

RESISTANCE, Banks and Units.
Cutler-Hammer Mfg. Co.
Dixon Crucible Co., Joseph.
General Electric Co.
Independent Electric Mfg. Co.
Sprague Electric Co.
Sundh Electric Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

RESISTANCE WIRE & RIBBON.
Belden Mfg. Co.
Driver-Harris Wire Co.
Moore, Alfred F.

REVERSING CONTROLLERS FOR CRANES, ETC.
Cutler-Hammer Mfg. Co.
Electric Controller & Mfg. Co.
General Electric Co.
Independent Electric Mfg. Co.
Westinghouse Electric & Mfg. Co.

RHEOSTATS.
Allis-Chalmers Manufacturing Co.
Cutler-Hammer Mfg. Co.
Electric Controller & Mfg. Co.
Fort Wayne Electric Works.
General Electric Co.
Independent Electric Mfg. Co.
Sundh Electric Co.
Sprague Electric Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

SEARCHLIGHTS, Portable.
Electric City Sales Co.

SECOND HAND MACHINERY.
Gregory Electric Co.

SHADE HOLDERS.
Bridgeport Brass Co.
General Electric Co.
J. E. M. Shadeholder Co.
Western Electric Co.

SHADES, Metallic.
Benjamin Electric Mfg. Co.
Central Electric Co.
Federal Sign System (Electric).
W. R. Ostrander & Co.
Holophane Works of General Electric Co.
Pass & Seymour, Inc.

SHEETS, Iron and Steel.
American Sheet & Tin Plate Co.

SHOCK ABSORBERS.
Benjamin Electric Mfg. Co.

SHOE DRYERS, ELECTRIC.
Hamilton-Beach Co.

SIGNS, Electric.
Universal Elec. Stage Ltg. Co.

SLEEVINGS.
Belden Mfg. Co.
Johns-Manville Co., H. W.
Standard Underground Cable Co.

SLEEVES, Paper.
Standard Underground Cable Co.

SMOKESTACKS, Steel.
Minneapolis Steel & Machinery Co.

SOCKETS AND RECEPTACLES.
Benjamin Electric Mfg. Co.
Bryant Electric Co.
Central Electric Co.
Cutler-Hammer Mfg. Co.
Federal Sign System (Electric).
General Electric Co.
Johns-Manville Co., H. W.
Pass & Seymour, Inc.
Trumbull Electric Mfg. Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.
Wirt Electric Specialty Co.

SOCKETS, LOCKING.
Pass & Seymour, Inc.

SOLDERING IRONS.
Simplex Electric Heating Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

SPRINGS.
American Platinum Works.
American Steel & Wire Co.

STAGE LIGHTING APPARATUS.
Albert & J. M. Anderson Mfg. Co.
Electric Apparatus Co.
General Electric Co.
H. W. Johns-Manville Co.
Sundh Electric Co.
Universal Stage Lighting Co.

STANDARD CELLS.
Leeds & Northrup Co.
Weston Electrical Instrument Co.

STAPLES AND TACKS, Insulating.
Blake Signal & Mfg. Co.

STEEL, Structural and Tool.
American Bridge Co.

STEREOPTICONS.
Universal Electric Stage Lighting Co.

STERILIZERS, Instrument.
Cutler-Hammer Mfg. Co.
Simplex Electric Heating Co.

STOKERS, Mechanical.
Babcock & Wilcox Co.
Westinghouse Machine Co.

STOVES, ELECTRIC.
General Electric Co.

STRAIN INSULATORS.
Albert & J. M. Anderson Mfg. Co.
Barnes & Kobert Mfg. Co.
General Electric Co.
H. W. Johns-Manville Co.

STREET LIGHTING FIXTURES, Incandescent.
Benjamin Electric Mfg. Co.
Brady Electric Mfg. Co.
Central Electric Co.
Federal Sign System (Electric).
Fort Wayne Electric Works.
General Electric Co.
Pittsburgh Transformer Co.

SUPPLIES, Electrical.
Bissell & Co., F.
Central Electric Co.
Commonwealth Edison Co.
Illinois Electric Co.
Manhattan Electrical Supply Co.
Stanley & Patterson.
Western Electric Co.

SWITCHBOARDS. (Switchboards and Panel Boards.)
Allis-Chalmers Manufacturing Co.
Electric Apparatus Co.
Electric Controller & Mfg. Co.
Fort Wayne Electric Works.
General Electric Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

SWITCHBOARDS, Theater.
Adam Electric Co., Frank.
Electric Apparatus Co.
Trumbull Electric Mfg. Co.
Universal Electric Stage Lighting Co.

SWITCHES.
Frank Adam Electric Co.
Allis-Chalmers Manufacturing Co.
Albert & J. M. Anderson Mfg. Co.
Benjamin Elec. Mfg. Co.
Bissell Co., F.
Bryant Electric Co.
Central Electric Co.
Columbia Metal Box Co.
Connecticut Electric Mfg. Co.
Crocker-Wheeler Co.
D & W Fuse Co.
Cutler-Hammer Mfg. Co.
Cutter Co.
Detroit Fuse & Mfg. Co.
Electric Controller & Mfg. Co.
Fort Wayne Electric Works.
General Electric Co.
Hart Mfg. Co.
High Tension Electrical Specialty Co.
Manhattan Electrical Supply Co.
Metropolitan Electric Mfg. Co.
Ostrander & Co., W. R.
H. T. Paiste Co.
Pass & Seymour, Inc.
Sorenson, P.
Sundh Electric Co.
Trumbull Electric Mfg. Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

TAPE, INSULATING.
American Electrical Works.
Belden Mfg. Co.
Central Electric Co.
D & W Fuse Co.
Diamond Rubber Co.
General Electric Co.
Johns-Manville Co., H. W.
Kerite Insulated Wire & Cable Co.
Marion Insulated Wire & Rubber Co.
Mica Insulator Co.
Mineraliac Electric Co.
N. Y. Insulated Wire Co.
Packard Electric Co.
Okonite Co.
Standard Paint Co.
Standard Underground Cable Co.
Western Electric Co.

TAPS, Current.
Benjamin Electric Mfg. Co.
Jordan Bros., Inc.
Manhattan Electrical Supply Co.
Pass & Seymour, Inc.

TELEPHONES AND SWITCHBOARDS.
Automatic Electric Co.
Central Electric Co.
Central Telephone & Electric Co.
Kellogg Switchboard & Supply Co.
Manhattan Electrical Supply Co.
Menominee Electric Mfg. Co.
Stanley & Patterson.
Western Electric Co.

THERMOMETERS, Electric.
Bristol Company.
Leeds & Northrup.

TOOLS, Cable Pulling.
American Steel & Wire Co.
B. F. Goodrich Co.
General Electric Co.
Hazard Mfg. Co.
Packard Electric Co.
Roebling's Sons Co., John A.
Safety Insulated Wire & Cable Co.

TOOLS, Commutator Truing.
Fort Wayne Electric Works.
General Electric Co.
Jordan Bros.

TOOLS, Linemen's.
Central Electric Co.
Mathias Klein & Sons.
Oshkosh Mfg. Co.
Sprague Electric Works.

TOOLS, Portable Electric Polishers, Buffers, Drills, Grinders, Hammers.
Daugherty-Smith-Phillips Co.
Emerson Electric Mfg. Co.
Fort Wayne Electric Works.
General Electric Co.
Hamilton-Beach Co.
Robbins & Myers Co.
Roth Bros. & Co.
Sprague Electric Works.
Western Electric Co.

TORCHES AND FURNACES, Gasoline.
Bridgeport Brass Co.
McGill Mfg. Co.

TOYS AND NOVELTIES.
Manhattan Electrical Supply Co.
Stanley & Patterson.

TRANSFORMERS.
Allis-Chalmers Manufacturing Co.
Central Electric Co.
Crocker-Wheeler Co.
Duncan Electric Mfg. Co.
Fort Wayne Electric Works.
General Electric Co.
Kuhlman Electric Co.
Manhattan Electrical Supply Co.
Packard Electric Co.
Pittsburgh Transformer Co.
Triumph Electric Co.
Wagner Electric Mfg. Co.
Westinghouse Electric & Mfg. Co.

TRANSMISSION MATERIAL.
Dossert & Co.
General Electric Co.
H. W. Johns-Manville Co.

TREE INSULATORS.
Albert & J. M. Anderson Mfg. Co.
Brookfield Glass Co.
High Tension Electrical Specialty Co.

TROLLEY WHEELS.
General Electric Co.
H. W. Johns-Manville Co.

TROLLEYS AND CHAIRS.
F. Bissell Co.

TUBING, Brass and Copper.
Bridgeport Brass Co.

TURBINE GOVERNORS.
Allis-Chalmers Manufacturing Co.
General Electric Co.

TURBINES, STEAM.
Allis-Chalmers Manufacturing Co.
General Electric Co.
Westinghouse Machine Co.

TURBINES, Water.
Allis-Chalmers Manufacturing Co.

UNDERGROUND INSTALLATIONS.
Gest, G. M.
Graner-Mahoney Contracting Co.
Standard Underground Cable Co.
J. W. Turner Improvement Co.

VACUUM CLEANERS.
Central Electric Co.
Federal Sign System (Electric)

VARNISH, Insulating.
General Electric Co.
Massachusetts Chemical Co.
Mineraliac Electric Co.
Packard Electric Co.
Sherwin-Williams Co.
Standard Paint Co.
Standard Underground Cable Co.
Westinghouse Electric & Mfg. Co.

VIBRATORS.
Hamilton-Beach Co.

WASHERS, Clothes (Motor Driven).
Federal Sign System (Electric).
Newton Washing Machine Co.

WATTMETERS, Integrating.
Duncan Electric Mfg. Co.
Federal Sign System (Electric).
Fort Wayne Electric Works.
General Electric Co.
Sangamo Electric Co.
Westinghouse Elec. & Mfg. Co.

WINDERS, Electro-Magnet.
Appleton Electric Co.
Belden Mfg. Co.

WINDLASSES, Arc Lamp.
Brady Electric Mfg. Co.

WIRE, ASBESTOS COVERED.
Belden Mfg. Co.

WIRE, Bare and Insulated.
American Electrical Works.
American Insulated Wire & Cable Co.
American Steel & Wire Co.
Atlantic Insulated Wire & Cable Co.
Belden Mfg. Co.
Bridgeport Brass Co.
Chicago Fuse Mfg. Co.
D & W Fuse Co.
Detroit Insulated Wire Co.
Driver-Harris Wire Co.
Electric Cable Co.
General Electric Co.
B. F. Goodrich Co.
Habirshaw Wire Co.
Hazard Mfg. Co.
Indiana Rubber & Insulated Wire Co.
H. W. Johns-Manville Co.
Independent Lamp & Wire Co.
Kerite Insulated Wire & Cable Co.
Lowell Insulated Wire Co.
Marion Insulated Wire & Rubber Co.
Moore, Alfred F.
National Conduit & Cable Co.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co.
Phillips, Eugene F.
Phillips Insulated Wire Co.
Roebling's Sons Co., John A.
Rome Wire Co.
Safety Insulated Wire and Cable Co.
Simplex Wire & Cable Co.
Standard Underground Cable Co.
Waterbury Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

WIRE, Enameled.
Belden Mfg. Co.
Westinghouse Electric & Mfg. Co.

WIRELESS APPARATUS.
Manhattan Electrical Supply Co.

ELECTRICAL MECHANICAL CONSULTING

Directory of Engineers

CONTRACTORS SPECIAL INTERESTS

American District Steam Company
Engineers and Contractors
Central Station Heating
Power, Lighting, Railways, Gas, Water Works
Plans, Specifications, Examinations and Reports
CHICAGO NORTH TONAWANDA SEATTLE

Ford, Bacon & Davis
Engineers
115 BROADWAY, NEW YORK
NEW ORLEANS SAN FRANCISCO

CHARLES L. PILLSBURY
CONSULTING, MECHANICAL and ELECTRICAL ENGINEER
Consulting Engineer to Minnesota State Board of Control
Suite 805 Metropolitan Life Bldg.
MINNEAPOLIS, MINN.

ERNEST J. ANDREWS
CONSULTING ELECTRICAL ENGINEER
SPECIALIZING IN ELECTRICAL PATENT CAUSES AND DAMAGE SUITS
1515 Monadnock Block
Telephone Harrison 2854 CHICAGO

C. W. HUMPHREY
CONSULTING AND DESIGNING ENGINEER
Plans, Specifications, Examinations, Supervision, Cost Analysis
Electrical Mechanical
THE ROOKERY — CHICAGO

Frederick Sargent Ayres D. Lundy
Wm. B. Monroe James Lyman
SARGENT & LUNDY
ENGINEERS
RAILWAY EXCHANGE
Cor. Jackson and Michigan Boulevards
CHICAGO

THE ARNOLD COMPANY
ENGINEERS
CONTRACTORS
Electrical—Civil—Mechanical
105 S. La Salle Street, CHICAGO

D. C. & WM. B. JACKSON
ENGINEERS
CHICAGO Harris Trust Bldg. BOSTON 248 Boylston St.
Plans, Specifications, Supervision of Construction
General Superintendence and Management
Examinations and Reports
Financial Investigations and Rate Adjustments

THE W. H. SCHOTT COMPANY
Engineers—Constructors—Managers
DEVELOP and MANAGE:
Electric Railways—Light and Power Plants—Hydro-Electric Developments, Central Station Heating Plants—Gas and Water-works. (Physical and Financial Examinations and Reports a Specialty.)
Harris Trust Bldg. - - CHICAGO

BADT-WESTBURG ELECTRIC CO.
ELECTRICAL ENGINEERS
Western Selling Agents for
Weston Electrical Instrument Co.
Ward Leonard Electric Co.
Suite 1504 Monadnock Block Chicago

The Lloyd-Thomas Co.
RECOGNIZED AUTHORITIES ON PHYSICAL VALUES
APPRAISERS ENGINEERS
PUBLIC UTILITY APPRAISALS A SPECIALTY.
4727-4737 Evanston Ave. Chicago

STONE & WEBSTER ENGINEERING CORPORATION
CONSTRUCTING ENGINEERS
BOSTON, MASS.

H. M. BYLLESBY & CO.
ENGINEERS
Insurance Exchange Building, Chicago
Trinity Building, New York

LAMAR LYNDON
CONSULTING ELECTRICAL ENGINEER
Long Distance Power Transmission and Alternating Current Problems a Specialty
2 Rector Street New York

Underwriters' Laboratories, Inc.
Under the Direction of the
National Board of Fire Underwriters
207 E. Ohio St., Chicago, Ill. W. H. Merrill, Mgr.
Branch Offices in all the Principal Cities of the United States and Canada

THE CENTRAL STATION ENGINEERING COMPANY
DESIGNERS AND BUILDERS
CENTRAL STATION HEATING PLANTS
Telephone Randolph 2495
First National Bank Bldg., Chicago

McMEEN and MILLER
(Incorporated)
Samuel G. McMeen Kempster B. Miller
Leigh S. Keith
ELECTRICAL and MECHANICAL ENGINEERS
1454 Monadnock Block Chicago

The J. G. White Companies
Engineers—Managers
Financiers
43 EXCHANGE PLACE, NEW YORK
Chicago San Francisco

DIXON - SMITH ENGINEERING COMPANY
CONSULTING ENGINEERS
Wright Building
Municipal St. Louis Industrial
Electric Lights Water Works Power Plants
Examinations, Reports, Estimates, Plans, Specifications, Supervision and Purchasing

NEW ENGLAND ENGINEERING CO.
ENGINEERS and CONSTRUCTORS
50 Church St. New York. Waterbury, Conn.
Investigations and Reports. Plans, Specifications, Estimates. Designs, Supervision, Construction

WOODMANSEE & DAVIDSON, INC.
ENGINEERS
First National Bank Building, CHICAGO

ELECTRIC POWER CONDUCTORS
By Wm. A. Del Mar, Asso. Mem. A. I. E. E.
69 Illustrations, 8 vo. Cloth, Price $2.00
This book is a technical treatise directed towards the solution of the economic problem of the choice of size, of style, of purchase, erection and maintenance of wires and cables for electric power transmission.
CONTENTS: Materials and Gauges; Electrical Properties; Insulation and Insulated Conductors; Determination of Size for Given Voltage, Drop and Power Loss; Determination of Size for Given Stress in Spans; Specifications; Testing Wire and Cable; Installation; Depreciation and Deterioration; Third Rail Circuits; Rail Bonds; Tables of Inductances, Reactance and Capacity.
For Sale by ELECTRICAL REVIEW PUBLISHING CO.
Western Headquarters for Electrical Books. 608 So. Dearborn Street, Chicago, Illinois.

ENGINEERS

THE ARNOLD COMPANY is now making reports upon valuation of physical property and operating conditions of extensive public utility companies to financial interests contemplating reorganization and betterments; upon present operation conditions, feasibility of electrification and utilization of hydro-electric power in the operation of trunk line steam railroads; the valuation of large public utilities for purposes of establishing rates or franchise extension negotiations.

THE ARNOLD COMPANY is now preparing plans and specifications covering complete industrial plants, railroad shops, hydro-electric development, interurban railways and electrification of steam roads; is constructing in accordance with its recommendations and plans complete industrial properties ready for service, thus creating complete properties from inception to operation; all under one contract agreement.

THE ARNOLD COMPANY, or BION J. ARNOLD, its President, has for the past 18 years served clients along the above lines involving work throughout the United States and several provinces of Canada, aggregating over three hundred millions of dollars in value.

THE ARNOLD COMPANY
ENGINEERS - CONSTRUCTORS
ELECTRICAL — CIVIL — MECHANICAL
105 SOUTH LA SALLE STREET
CHICAGO

CONSTRUCTORS

Charles L. Pillsbury

Consulting, Mechanical and
Electrical Engineer

Consulting Engineer to Minnesota State Board of Control

Investigations and Appraisals of
Public Utilities

Suite 805-11 Metropolitan Life Building
Minneapolis, Minn.

Suite 716-20 Capital Bank Building
St. Paul, Minn.

WE SHALL KEEP OPEN HOUSE AT OUR OFFICES DURING CONVENTION WEEK AND YOUR VISIT WILL BE APPRECIATED

SARGENT & LUNDY ENGINEERS

Frederick Sargent Ayres D. Lundy
Wm. S. Monroe James Lyman

In the Railway Exchange
Jackson and Michigan Boulevards
CHICAGO

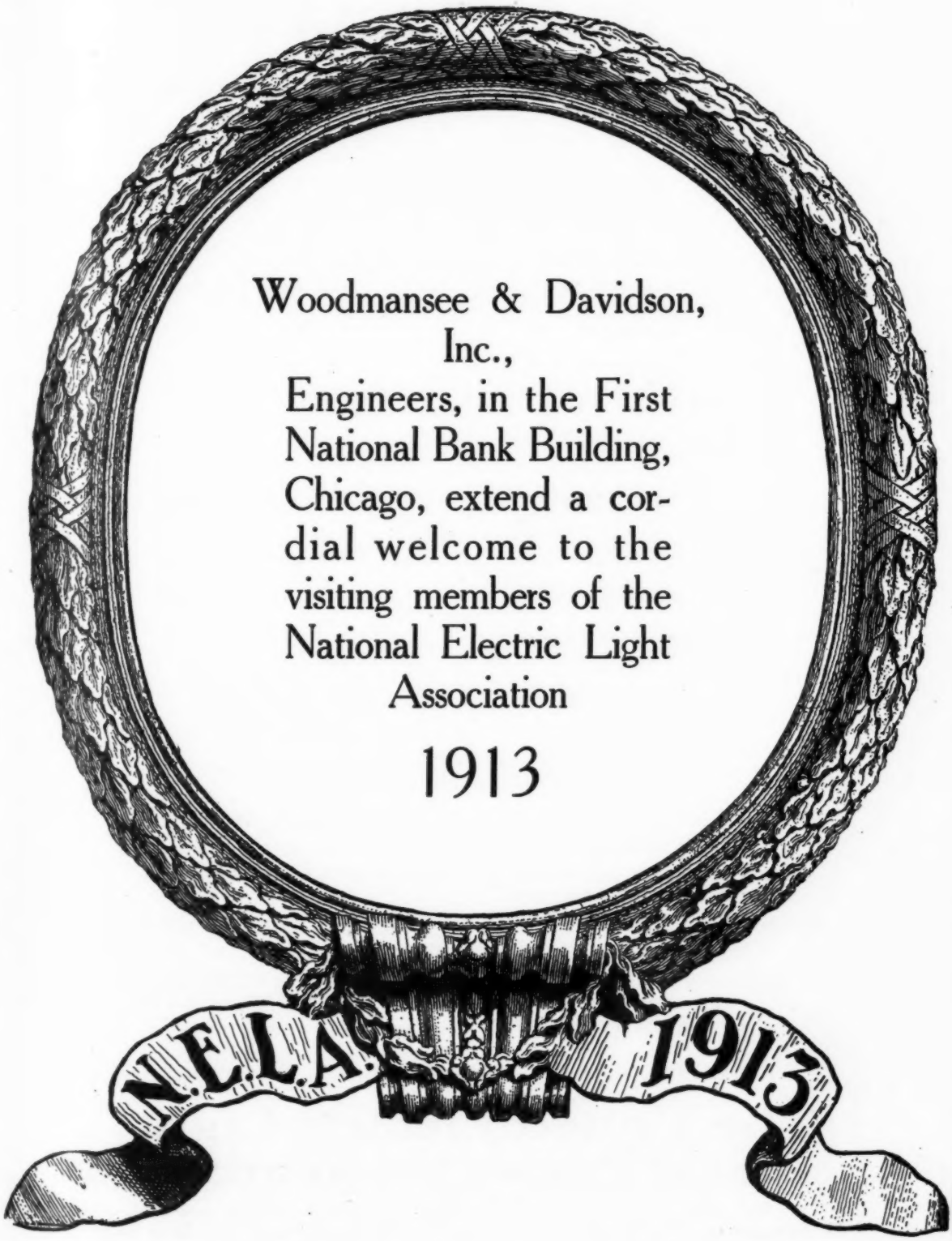
IS YOUR POWER PLANT MACHINERY TESTED AT THE FACTORY BEFORE SHIPMENT?

Result:

1. Acceptable apparatus only is shipped.
2. Quality and compliance with specifications is assured.
3. Expense is lower than if test is made after installation.
4. Reliable performance data is secured. Every operating engineer is glad to have such data on file.

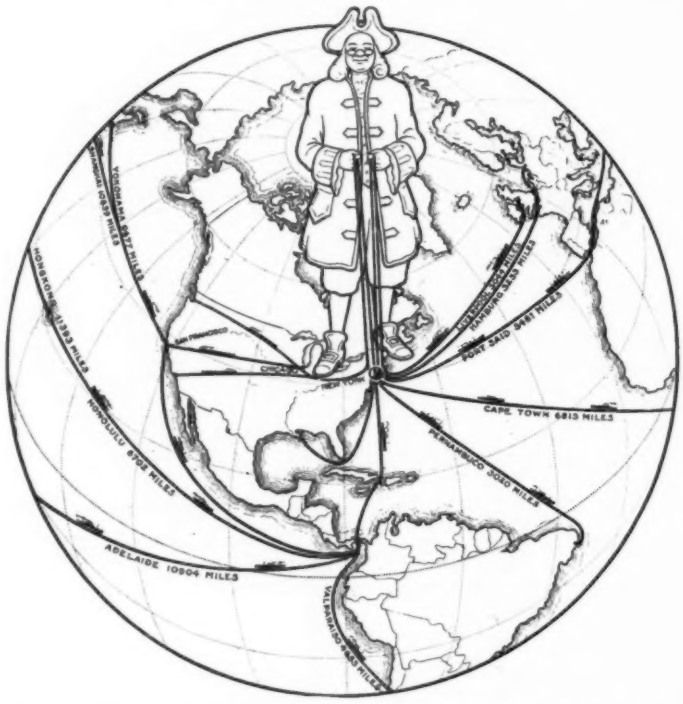
We have trained men for this class of tests and can undertake them at short notice.
Our facilities are at your service.

ELECTRICAL TESTING LABORATORIES
80th Street and East End Avenue, New York, N. Y.


Woodmansee & Davidson,
Inc.,
Engineers, in the First
National Bank Building,
Chicago, extend a cor-
dial welcome to the
visiting members of the
National Electric Light
Association
1913
N.E.L.A.
1913

NEW YORK CITY
and
UNITED SERVICE

At the Crossroads of the World



In New York City 10% of the manufactured product of the United States is produced.

In New York City is located the greatest retail and wholesale market in the country.

In New York City will be found the largest and most diversified labor market in the United States.

In New York City ELECTRICITY is available at practically every point and at rates, for POWER and LIGHTING, that will meet every requirement.

Let us find you a site and quote you rates for current

The United Electric Light and Power Company

Main Office:
1170 Broadway, New York
Telephone, 4070 Mad. Sq.

Branch Office & Showroom:
138 Hamilton Place, New York
Telephone, 4000 Audubon

Philadelphia contains more residences and householders than any other city in the United States! There is no better advertising soil to be cultivated than a city of homes where every housekeeper is on the lookout for the latest and best product.

In spite of these facts National Advertisers have practically neglected the great business building possibilities of Electric Signs in Philadelphia. The first one in the field will obtain the largest returns. Our Sign Department will recommend locations and furnish complete estimates for the cost of building, erecting and operating a Sign or Signs to meet your requirement.

THE PHILADELPHIA ELECTRIC COMPANY

TENTH AND CHESTNUT STS.

To the Members of the
National Electric Light Association
attending the
1913 Convention at Chicago

Greetings

To all, whether from North or South, East or West, our Congratulations and the wish that this year's gathering be as successful as the Seattle Convention of last year

At Your Service

The New York Edison Company

ELECTRIC SHOP Offers

Many Advantages To Purchasers of

Electrical Goods

of Every Description

Reproduction showing front and back covers of the new ELECTRIC SHOP Catalogue, just issued. Beautifully printed in colors.

EVERY Central Station customer in the United States can and should take advantage of the **Buying Power** of ELECTRIC SHOP. The Commonwealth Edison Company, owner of ELECTRIC SHOP, is well established and its financial standing and opportunity for purchasing in vast quantities enable it to sell the highest quality of electrical goods of all kinds at the lowest prices. The unvarying principle of keeping merchandise of the highest quality only is strictly adhered to, and it should always be remembered that ELECTRIC SHOP stands back of every article it sells.

Central Station Managers are Invited

to send us names of their best lighting customers to which they would like us to mail a copy of our new ELECTRIC SHOP Catalogue, just issued. You are also invited to visit ELECTRIC SHOP while in attendance at the June N. E. L. A. Convention in Chicago. It is only through such a visit that one may fully realize the complete stock of electrical goods, the beauty and art of the lamps displayed, and the facilities for supplying electrical merchandise, which ELECTRIC SHOP offers. The number of appliances on your lines is sure to be increased as your customers are brought to realize the number and the great convenience of modern electrical appliances.

ELECTRIC SHOP—CHICAGO

Jackson and Michigan Boulevards

ELECTRIC SHOP—CHICAGO,
Jackson and Michigan Boulevards.

Please send me blank request sheet for ELECTRIC SHOP Catalogues.

Name.....

Address.....

Company.....

Date.....1913.

186-R

A SIGNIFICANT FACT

Cleveland has a number of very large industries using a thousand or more of horse power. It is a significant fact that some of them prefer to buy "Illuminating" service rather than make power themselves even under the most favorable conditions.

Cheap Industrial Power **Reliable "Illuminating" Service**

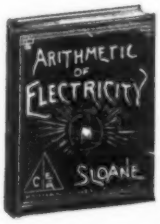
Cleveland
Sixth City

The Cleveland Electric Illuminating Company

ARITHMETIC OF ELECTRICITY

By PROF. T. O'CONOR SLOANE

Price $1.00



A PRACTICAL Treatise of 165 Pages on Electrical Calculations of all kinds reduced to a series of rules, all of the simplest forms, and involving only ordinary arithmetic; each rule illustrated by one or more practical problems, with detailed solution of each one. Followed by an extensive series of Tables, including the following subjects: All Kinds of Units of Measurement of Electrical and Mechanical Work, Energy and Heat; Relations of Different Systems of all kinds of Units; Relation of Different Wire Gauges, American and Foreign; Electrical Properties of Wire of Different Sizes; Specific Resistances; Thermo chemical and Electro-chemical Equivalents; Useful Factors, etc., etc.

This book may be classed among the most useful works published on the science of electricity, covering, as it does, the mathematics of electricity in a manner that will attract the attention of those who are not familiar with algebraical formula.

AMONG THE CONTENTS ARE:

Chapter I.—Introductory. Chapter II.—Ohm's Law. Chapter III.—Resistance and Conductance. Chapter IV.—Potential Difference. Chapter V.—Circular Mills. Chapter VI.—Special Systems. Chapter VII.—Work and Energy. Chapter VIII.—Batteries. Chapter IX.—Electro-Magnets, Dynamos and Motors. Chapter X.—Electric Railways. Chapter XI.—Alternating Currents. Chapter XII. Condensers. Chapter XIII.—Demonstration of Rules. Chapter XIV.—Notation in Power of Ten, Tables.

ELECTRICAL REVIEW PUBLISHING COMPANY
Western Headquarters for Electrical Books
608 So. Dearborn St., Chicago, Ill. ***Complete Stock of All Electrical Books on Hand***

Advantages of Brooklyn, N. Y. For Manufacturing Purposes

Manufacturers who may be considering establishing factories or changing locations are invited to consider the advantages of Brooklyn, N. Y., for manufacturing purposes of all kinds.

Remarkable Waterfront, Railway and Shipping Facilities

Brooklyn contains 77 square miles and has a population in excess of 1,800,000. It stands at the gateway of the Western World, with a commercial waterfront of 31 miles, which is being largely increased by harbor operations now under way.

It has the largest docks in the world, made of steel and concrete, 1500 feet long, 150 feet wide and with a water depth of from 40 to 50 feet.

Land adjacent to this waterfront may be acquired at reasonable cost, or model factories already erected, or if desired, built to order, may be leased at equitable rentals. Railroad and shipping facilities are unexcelled. It is possible to ship or receive goods from all parts of the world merely by placing them on an elevator.

Unexcelled Labor Market

There is always available a plentiful supply of skilled and unskilled labor of all kinds, and strikes and lockouts are practically unknown.

There are homes at reasonable rentals for all classes, Brooklyn being an exceedingly attractive place in which to live.

Cheap Electric Power

Brooklyn is notable for its supply of cheap and reliable electric power for all industrial purposes. The enterprise located here may purchase its complete supply of electric energy, either alternating or direct, from the Edison Electric Illuminating Company of Brooklyn at a rate less than the cost of generating would be and is thus enabled to save a large investment for power plant purposes and to utilize this capital in the actual operations of the business.

A Great Industrial Community

For the reasons above enumerated, Brooklyn has become a magnet to manufacturers. A census shows that in the spring of 1912 there were 12,400 manufacturing establishments in Brooklyn with an invested capital of $605,000,000, employing 240,500 wage earners, with a total annual wage of $140,000,000 and producing goods valued at $870,000,000.

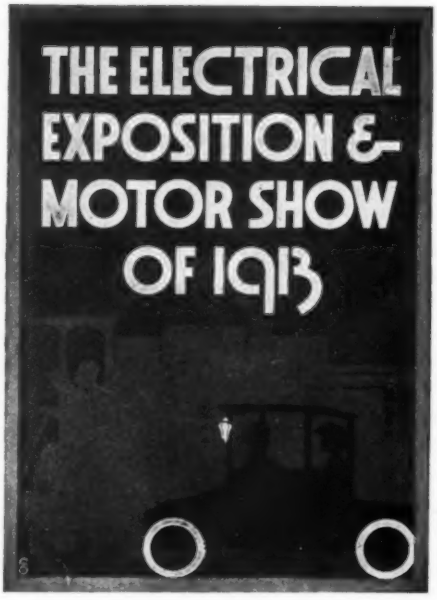
To interested manufacturers or capitalists the undersigned will be glad to supply detailed information and furnish particulars concerning desirable sites for different classes of business.

Write for "Industrial Brooklyn" booklet.

Edison Electric Illuminating Co. of Brooklyn

General Offices: 360 Pearl Street **Brooklyn, New York**

The Big Show of the Year



October 15th to 25th 1913 at the New Grand Central Palace New York City

The Electrical Exposition and Motor Show

each year is the big event of the electrical industry. Thousands of interested people daily visit the show and place orders for things electrical. Here is your chance to reach many a prospective buyer, who is prepared to purchase

Reservations for space should be made now

Offices 124 West 42d Street, N Y

THE PHILADELPHIA STORAGE BATTERY COMPANY

recommends its

THIN PLATE BATTERIES

for

ALL CLASSSS

of

ELECTRIC VEHICLE SERVICE

THE PHILADELPHIA STORAGE BATTERY COMPANY has taken this stand, not rashly, but because for SIX YEARS PHILADELPHIA THIN PLATES have proven their worth under ALL conditions of actual service.

For high mileage or low mileage—on hilly routes or on the level—from pleasure cars to parcel delivery and heavy trucking—you can insure the greatest economy of operation by using a PHILADELPHIA THIN PLATE BATTERY.

One of our pamphlets explains the reasons. Why not write for it?

PHILADELPHIA STORAGE BATTERY COMPANY

"Originators of the THIN PLATE"

Ontario and C Streets, Philadelphia, Pa.

PHILADELPHIA NEW YORK CHICAGO BOSTON WASHINGTON
ST. LOUIS ROCHESTER DENVER TORONTO
CLEVELAND PASADENA LOS ANGELES

Why Pick Out the Little Things?

Don't push aside the profitable Electric Vehicle Load. Compare the Revenue from Electric Trucks and Electric Irons—25 **dollars** to 50 **cents.**

IF YOU RECOMMEND

Edison Storage Batteries

Your Customers Get Guaranteed Service.

Put a salesman on the Vehicle Load with Edison Battery sales arguments—and help of our Engineers if he wants it. Don't let this get by you another season.

Edison Storage Battery Company

105 Lakeside Ave. **Orange, N. J.**

Send for information regarding the Edison Alternating Current Rectifier, for charging ignition and lighting batteries.

A Gould Storage Battery that is doing splendid work in a large Canadian plant

This is one of two 60-cell Gould Storage Batteries installed in the terminal station of the Canadian Light, Heat & Power Co. in Montreal for supplying current to excite the generators, operate oil switches and for emergency lighting in the event of failure of exciter or lighting system in the power house. This company also has a very much larger Gould Battery in its main plant.

Within the wide range of its proper application, a Gould Storage Battery is capable of yielding greater benefits and paying greater dividends on the investment than is any other single element in an electric power plant.

The precise manner in which the battery operates to reduce power generating and load regulating costs in different classes of service and those conditions under which the battery is of greatest value are matters which our engineers will gladly explain to any interested party.

Tell us your conditions and get our free advice.

We also make types of storage batteries for automobile starting, lighting, ignition and propulsion.

Gould Storage Battery Co.

GENERAL OFFICES: 30 EAST 42nd ST., NEW YORK CITY

BOSTON: 89 State Street
PHILADELPHIA: 613 Betz Building
CLEVELAND: American Trust Building
DETROIT: 999 Woodward Avenue
CHICAGO: The Rookery
SAN FRANCISCO: 904 Rialto Building

WORKS: DEPEW, NEW YORK

AGENTS: WASHINGTON, KANSAS CITY, DENVER, TOPEKA, LOS ANGELES, SEATTLE, MONTREAL, TORONTO, WINNIPEG

Full stock carried in all cities where we have offices or agents.

62

Here's some real information for Central Stations interested in Electric Vehicles ←

New York City

is to have 40 more Storage Battery Cars equipped with

"Hycap-Exide" Batteries

Here's the history of the "Hycap-Exide" Battery in storage battery street car service in New York City:

On May 21st, 1910, The Third Avenue Railway Co. ordered 1 "Hycap-Exide" Battery for experimental use on a storage battery car.

On June 8th, 1911, The Third Avenue Railway Co. ordered 35 more "Hycap-Exide" Batteries. The satisfactory service from the first experimental battery prompted the company to place their order for these additional batteries.

On October 24th, 1911, The Third Avenue Railway Co. placed their order for 15 more "Hycap-Exide" Batteries.

And, on April 4th, 1913, The Belt Line Corporation, controlled by the same interests as The Third Avenue Railway Co., placed their order for 40 more "Hycap-Exide" Batteries.

Here are two significant facts: The Third Avenue Railway Co. tested out every make of battery and as a result every storage battery car ordered since the first purchase of 35 in June, 1911, has been equipped with "Hycap-Exide" Batteries.

The fifty cars, purchased in 1911 and equipped with "Hycap-Exide" Batteries during the year 1912 ran over 750,000 car miles.

Batteries that will show satisfactory results in street cars will surely give good service in electric vehicles.

THE ELECTRIC STORAGE BATTERY CO.

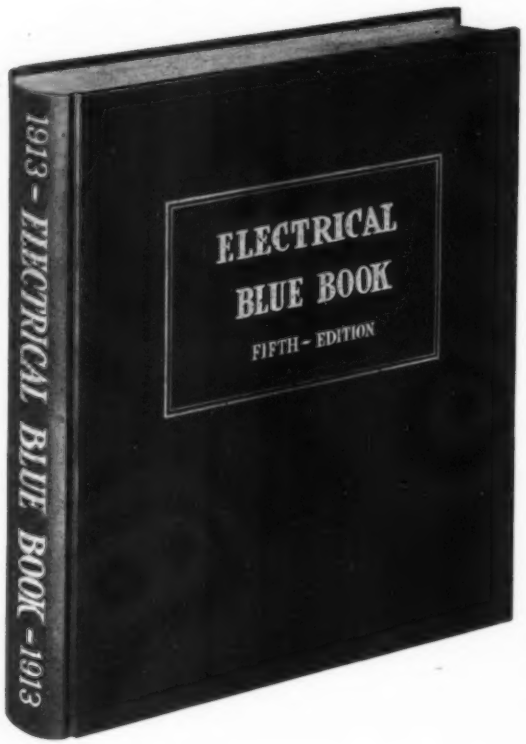
MANUFACTURER OF

The "Chloride Accumulator", The "Tudor Accumulator"
The "Exide", "Hycap-Exide" "Thin-Exide" and "Ironclad-Exide" Batteries

New York Boston Chicago
St. Louis Cleveland Atlanta Detroit

PHILADELPHIA, PA.
1888-1913

Denver San Francisco Seattle
Los Angeles Portland, Ore. Toronto



Do You Want a Free Copy of the 1913 Electrical Blue Book?

If you are a buyer of electrical material, or if you influence the buying of electrical material, you are entitled to a copy of the Electrical Blue Book and may receive it without cost, carriage charges prepaid.

The Electrical Blue Book contains the exhibits of manufacturers of both Approved and General Electrical Material; the National Electrical Code illustrated and explained; Index of Rules, National Electrical Code; and List of Approved Fittings.

10,000 copies will be distributed September 15, 1913. As the demand exceeds the supply, it is advisable to make immediate application. Simply fill out and mail the coupon; your name will be entered on the list and you will receive a copy at the time of distribution.

Additional copies may be had at $2.00 each.

ELECTRICAL BLUE BOOK, 608 So. Dearborn St., Chicago

Please enter my name to receive a free copy of the 1913 Electrical Blue Book.

Name of Company_____

Business _____

City_____ **State**_____

Name and Position of Buyer_____

5

An Open Letter to Central Station Managers:

Arthur Williams, *President* Frank W. Smith, *Vice-President* Harvey Robinson, *Secretary* Day Baker, *Treasurer*

Electric Vehicle Association of America

Directors

W. P. Kennedy — Louis A. Ferguson
W. G. Bee — W. W. Freeman
James T. Hutchings — F. M. Tait
Hayden Eames — E. S. Mansfield
Charles Blizard — G. H. Kelly
W. H. Blood, Jr. — P. D. Wagoner

Sub-Committee
(Conducting Campaign)
Frank W. Smith, Chairman
The United Elec. Light & Power Co.
W. H. Blood, Jr.
Stone & Webster Mngmnt. Ass'n
Arthur Williams
The New York Edison Co.

Official Organ
THE CENTRAL STATION
29 Park Row, New York

Office of Sub-Committee: 1170 Broadway New York

General Counsel
BEARDSLEY, HEMMENS & TAYLOR
44 Wall Street, New York

General
Publicity and Advertising Committee

Charles L. Edgar, Chairman
Edison Elec. Illg. Co. of Boston
W. C. Anderson
Anderson Electric Car Co.
Charles Blizard
Electric Storage Battery Co.
W. H. Blood, Jr.,
Stone & Webster Mngmnt. Ass'n
N. F. Brady
The New York Edison Co.
G. W. Brine
Georgia Ry & Electric Co.
John A. Britton
Pacific Gas & Electric Co.
H. M. Byllesby
H. M. Byllesby & Co.
W. L. Case
Lansden Co.
Thomas A. Edison
Edison Storage Battery Co.
A. C. Einstein
Union Elect. Lt. & Power Co.
W. W. Freeman
Alabama Power Co.
Frank W. Frueauff
Denver Gas & Electric Co.
F. H. Gale
General Electric Co.
W. S. Gould
Gould Storage Battery Co.
George H. Harries
Minneapolis Genl. Elec. Co.
Charles R. Huntley
Buffalo General Electric Co.
Samuel Insull
Commonwealth Edison Co.
Arthur B. Lisle
Narragansett Elec. Light Co.
J. B. McCall
Philadelphia Electric Co.
T. N. McCarter
Public Service Corp. of N. J.
J. C. McQuiston
Westinghouse Elec. & Mfg. Co.
F. S. Marr
Philadelphia Storage Battery Co.
John B. Miller
Southern California Edison Co.
J. B. Murray
Edison Elec. Illg. Co. of Brooklyn
R. C. Norton
Baker Motor Vehicle Co.
H. H. Rice
The Waverley Co.
R. M. Searle
Rochester Ry & Light Co.
Frank W. Smith
The United Elec. Light & Power Co.
F. M. Tait
Dayton Power & Light Co.
P. D. Wagoner
General Vehicle Co.
Charles A. Ward
Ward Motor Vehicle Co.
Arthur Williams
The New York Edison Co.

May 1st, 1913.

To Central Station Managers Everywhere:

The growth of the Electric Vehicle Industry has brought increased revenue to the Central Station.

The advertising conducted during the past year by this Association has been productive of splendid results. It has done a great deal toward convincing the public of the value of the Electric Vehicle, but the foundation has only been laid.

If we want to secure the fullest returns from our first expenditure, we must continue our educational campaign until an indelible impression has been made on the mind of the public. This can only be done by reiteration, by advertising the fundamental principles of the Electric Vehicle again and again.

The committee desires to raise for the second year's campaign a fund of $75,000. Will you not do your part and help the cause. Every central station has been benefited by the past advertising and sooner or later the Electric Vehicle as a current consuming device will be a factor in your situation, providing the co-operative work of all interested is continued.

WE WANT THE NAME OF EVERY CENTRAL STATION COMPANY ON THE LIST OF CONTRIBUTORS.

The advertising copy so far has been largely educational. During the next year it is the purpose of the Association to cover the field more specifically with concrete facts and figures as to the economies and all around adaptability and dependability of the Electric Vehicle to every need, both pleasure and commercial.

Approximately $20,000. has already been subscribed and pledged on personal solicitation.

A subscription from each of the central station companies will be a splendid moral and financial support and help the electric lighting industry as a whole.

May we hear from you promptly?

Yours very truly,

Frank W. Smith

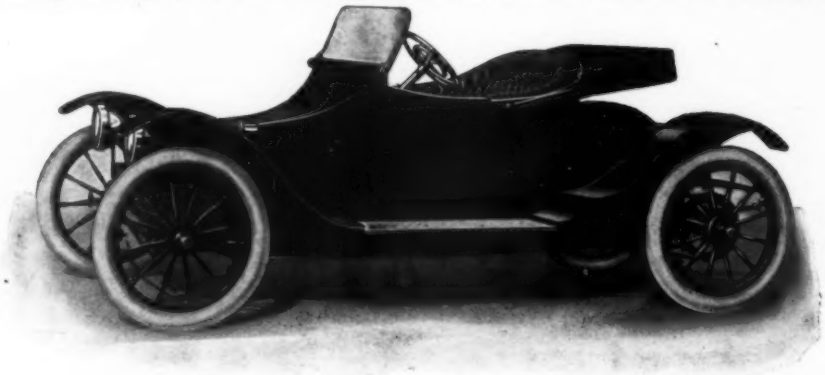
Chairman, Sub-Committee on
Publicity & Advertising.

Be sure to visit our booth at the 1913 N. E. L. A. Convention at Medinah Temple, Chicago, June 2-6

(68)

Bailey Electric Roadster

Especially Designed for ELECTRIC LIGHT AND POWER COMPANIES



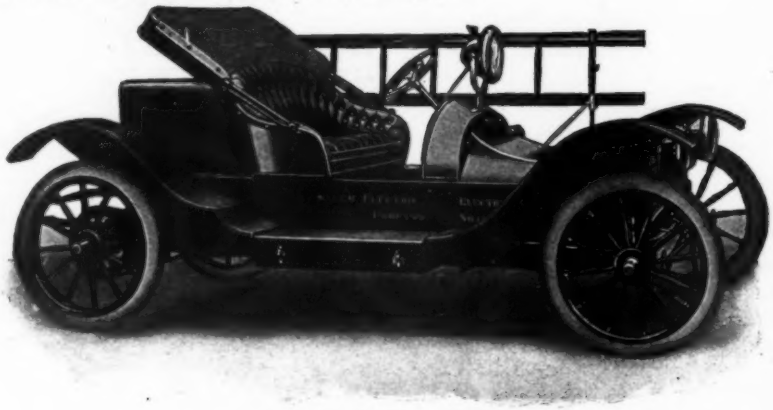
"FAST RUNABOUT

On May 5, 1913, a Bailey Roadster ran on one charge of battery from Boston to Springfield, Mass., 93.4 miles, over a hilly road in 4 hours 55 minutes. Run was then continued to Holyoke and back to Springfield, making a total of 114.7 miles on one charge. The Edison battery used on this run had been in steady service for 3½ years.

WATCH THIS LIST GROW

The following are electric light companies which have placed orders up to date:—

EDISON ELECTRIC ILLUMINATING CO., of Boston (19)
MALDEN ELECTRIC CO., Malden, Mass. (3)
SCHENECTADY ILLUMINATING CO., Schenectady, N. Y. (2)
BLACKSTONE VALLEY GAS & ELECTRIC CO., Pawtucket, R. I. (2)
COMMONWEALTH EDISON CO., Chicago (2)
OMAHA ELECTRIC LIGHT & POWER CO., Omaha, Neb. (2)
HAVERHILL ELECTRIC CO., Haverhill, Mass.
FRANKLIN ELECTRIC LIGHT CO., Turners Falls, Mass.
MINNEAPOLIS GENERAL ELECTRIC CO., Minneapolis, Minn.
STAMFORD GAS & ELECTRIC CO., Stamford, Conn.
SALEM ELECTRIC LIGHTING CO., Salem, Mass.
MONTREAL LIGHT, HEAT & POWER CO., Montreal.
CONCORD MUNICIPAL LIGHT PLANT, Concord, Mass.
LYNN GAS & ELECTRIC LIGHT CO., Lynn, Mass.
CAMBRIDGE ELECTRIC LIGHT CO., Cambridge, Mass.
NEW BEDFORD GAS & EDISON LIGHT CO., New Bedford, Mass.
HARRISBURG LIGHT & POWER CO., Harrisburg, Pa.
EDISON ELECTRIC ILLUMINATING CO., of Brockton, Mass.
COMMONWEALTH WATER & LIGHT CO., Summit, N. J.
CONSUMERS ELECTRIC LIGHT & POWER CO., New Orleans, La.
SUBURBAN GAS & ELECTRIC CO., Revere, Mass.
COSMOPOLITAN ELECTRIC CO., Chicago, Ill.



LIGHT SERVICE WAGON.

The large box back of the seat serves to carry arc lamp globes, carbons, etc., and on the inside is 32 inches long, 23¼ inches wide and 16⅞ inches high. Felt lined compartments to suit.

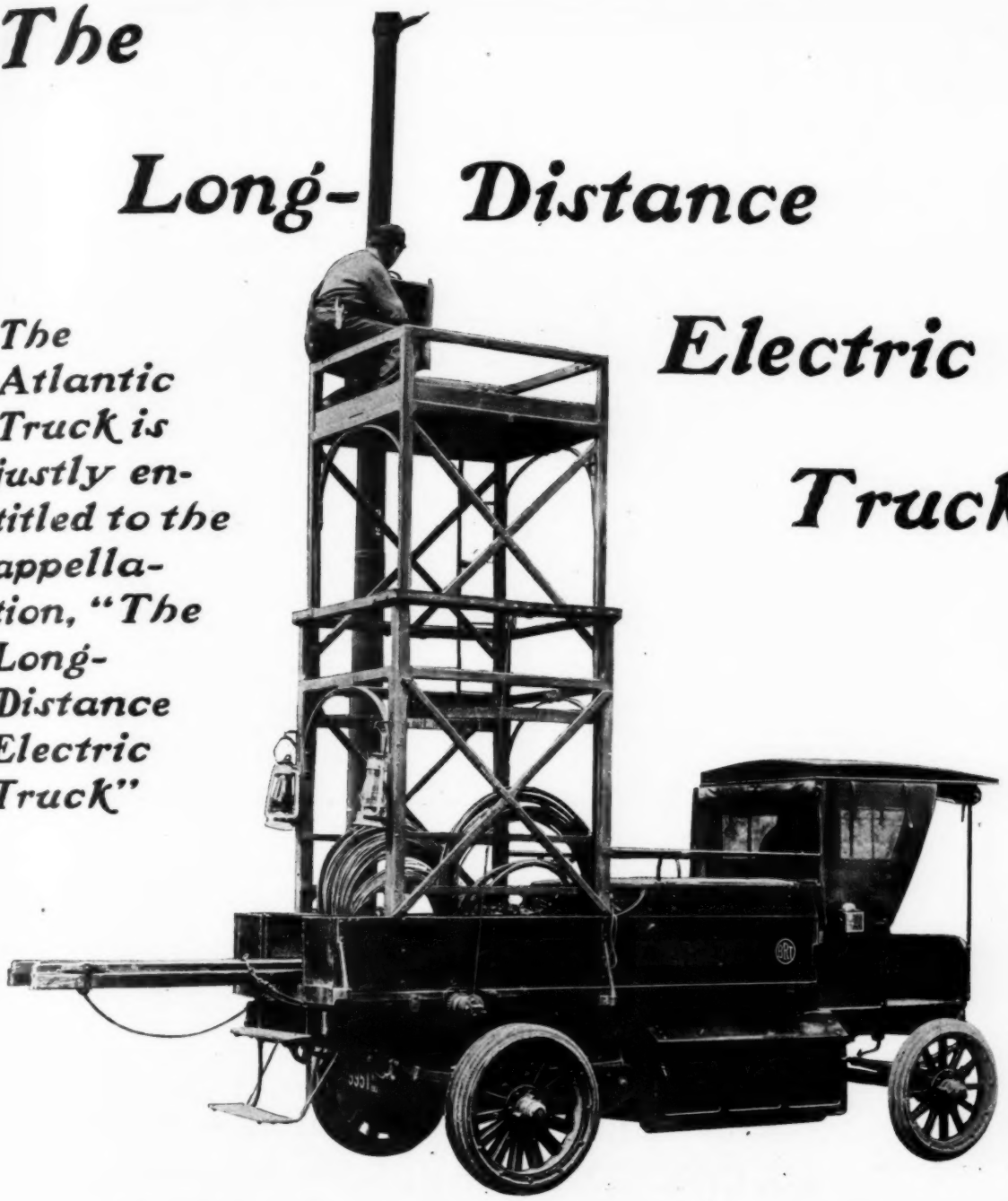
Each running board box measures inside 35 inches long, 12 inches wide and 5¼ inches high.

S. R. Bailey & Co., Inc., 895 Boylston St., Boston

Factory at Amesbury, Mass.

The Long-Distance Electric Truck

The Atlantic Truck is justly entitled to the appellation, "The Long-Distance Electric Truck"



Atlantic Vehicle Company's Truck in use by the Brooklyn Rapid Transit Company for Emergency Work

The amount of electricity stored in a storage battery is a fixed quantity, consequently that truck which uses the least quantity of electricity in going one mile will travel more miles per day than any other truck using such fixed quantity of power.

The reason why the Atlantic meets this requirement is because the best engineering talent in the United States was employed to design it.

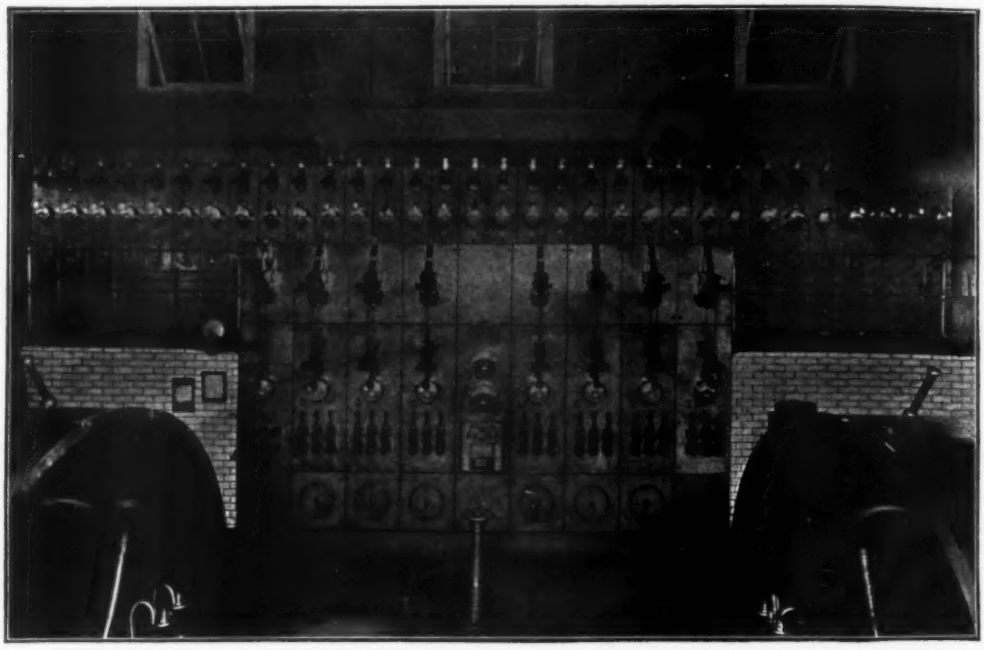
And—the fixed principles of the Company's founders have held of paramount importance—this:

"That in an Electric the maker should eliminate all frictions and every possible wastage of power at anything like reasonable cost and should secure the easiest rolling of the vehicle itself and a minimum of friction in all rotating parts."

Factory, Newark, N. J.

ATLANTIC VEHICLE CO., 1600 Broadway, New York; 10 Post Office Sq., Boston

An I-T-E Installation

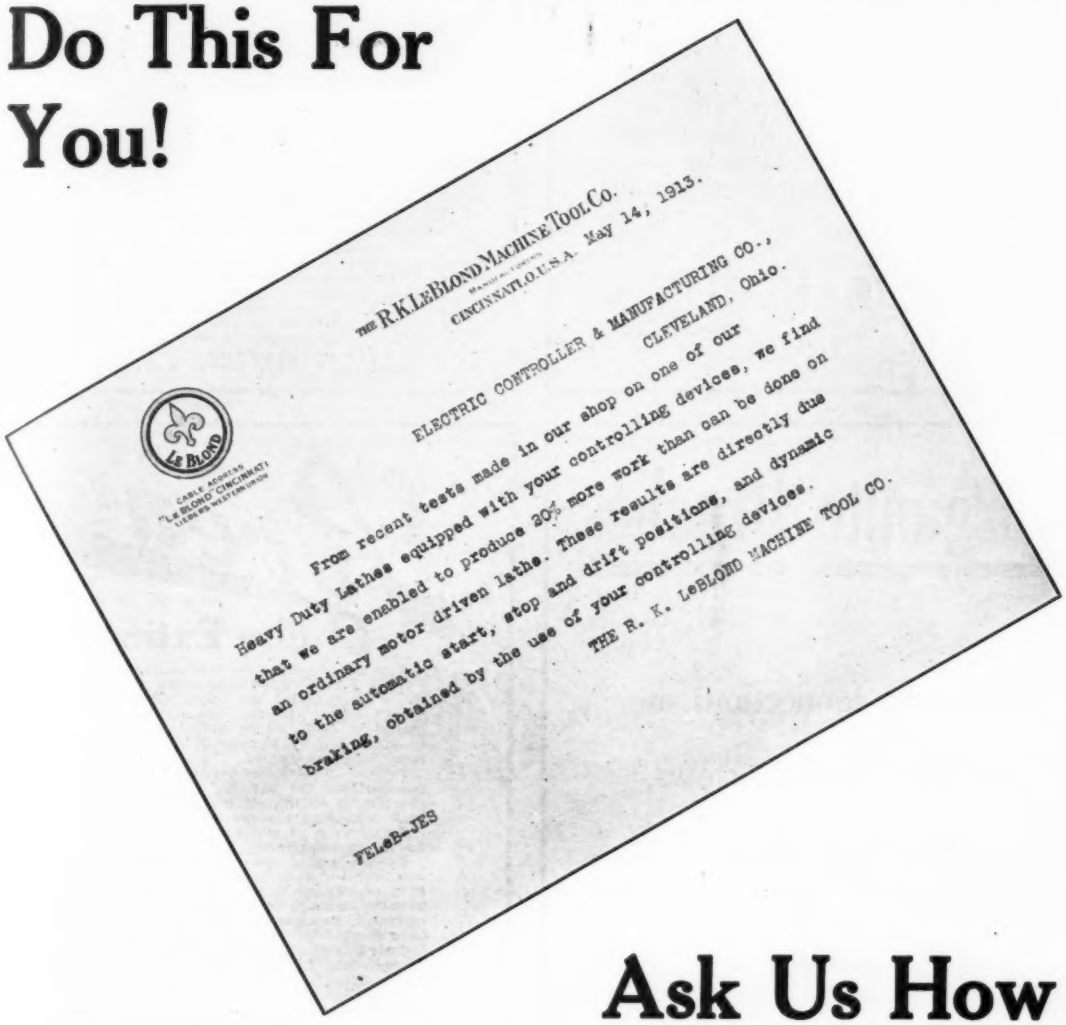


ORIGINALLY this fine CIRCUIT BREAKER installation was NOT I-T-E. TO-DAY it is. Specifications reading I-T-E or "equal" are misleading — the I-T-E CIRCUIT BREAKER has no equal.

THE CUTTER COMPANY **Main Office and Factory: PHILADELPHIA**

The Cutter Company, 120 Liberty Street, New York.
The Cutter Company, Monadnock Blk., Chicago.
The Cutter Company, Park Bldg., Pittsburg.
The Cutter Company, Ellicott Sq., Buffalo.
The Cutter Company, Ford Bldg., Detroit.
The Cutter Company, Pabst Bldg., Milwaukee.
Eccles & Smith Co., Los Angeles, San Francisco, Portland, Ore.
Electric Manufacturers Sales Co., Denver.
I-T-E Electric Co., 72 Finsbury Pavement, E. C., London.

Are You Interested in Increasing Your Output 10% to 40%? E. C. & M. Automatic Controllers For Machine Tools Will Do This For You!



THE R. K. LEBLOND MACHINE TOOL CO.
CINCINNATI, O. U.S.A. May 14, 1913.

ELECTRIC CONTROLLER & MANUFACTURING CO.,
CLEVELAND, Ohio.

From recent tests made in our shop on one of our Heavy Duty Lathes equipped with your controlling devices, we find that we are enabled to produce 30% more work than can be done on an ordinary motor driven lathe. These results are directly due to the automatic start, stop and drift positions, and dynamic braking, obtained by the use of your controlling devices.

THE R. K. LEBLOND MACHINE TOOL CO.

FELeB-JES

LE BLOND
CABLE ADDRESS "LE BLOND" CINCINNATI (LIEBER'S WESTERN UNION)

Ask Us How

THE ELECTRIC CONTROLLER & MFG. CO.

NEW YORK-50 CHURCH ST. CLEVELAND, OHIO CHICAGO-1417 MONADNOCK BLK.
PITTSBURG-1539 OLIVER BLDG. TORONTO-1222 TRADERS BANK BLDG. BIRMINGHAM-827 BROWN-MARX BLDG.

A fundamental factor of economy:

Quality is of more Importance than Price

A maxim particularly applicable in the purchase of carbon brushes. Look for length of service and general efficiency.

"LE CARBONE BRUSHES"

offer an unvarying standard so high that one brush chosen out of a million is the exact counterpart of every other. Reduced brush cost per K. W. hour and avoidance of commutator troubles follow the use of these brushes.

W. J. JEANDRON

171 Fulton St. New York

CARBON BRUSHES of highest efficiency are now demanded by our leading Electrical Engineers as a matter of ECONOMY. That's why LE VALLEY VITAE BRUSHES are specified. They fulfill every demand.

Try them at our expense.

LE VALLEY VITAE CARBON BRUSH COMPANY

No. 4125 Park Ave., New York City

The Simplest Small Motors on the Market containing neither rotating wires, carbon brushes nor commutators

PEERLESS INDUCTION MOTORS

are preeminently the motors to specify when alternating current is available for driving all kinds of small machines. Let our engineering department help you on special application problems. Write for Bulletin.

Agencies in all principal cities.

THE PEERLESS ELECTRIC CO., Warren, Ohio

Morganite Brushes

Battersea connections are without solder, screws, rivets or plugs.

The Morgan Crucible Co., Ltd.

114 Liberty Street,

NEW YORK CITY

Pyrene TRADE MARK

Fire Extinguishers

For use on fires in electrical equipment the Pyrene Fire Extinguisher is daily demonstrating its efficiency in the most exacting of tests. Every power house, central station, isolated plant—in fact, all electrical equipment—should be protected by Pyrene Fire Extinguishers, the most efficient known.

Pyrene in contact with fire separates the flames from the burning material, extinguishing the fire by lifting off the flames without in any way damaging the material not touched by fire.

Being void of moisture, Pyrene is a non-conductor of electricity.

Pyrene liquid may be directed between the commutator and brushes or the armature and field of any moving rotary without in any way causing damage to the apparatus or injuring the operator, irrespective of voltage used. This applies as well to controller boxes, rheostats, transformers, switchboards and all other electrical equipment. Pyrene will break an arc caused by short circuit and when broken, the arc will not re-establish.

Brass and Nickel Plated Pyrene Fire Extinguishers are the only one-quart fire extinguishers included in the lists of Approved Fire Appliances, issued by the National Board of Fire Underwriters.

Write for "Electrical Booklet"

PYRENE MFG. CO.

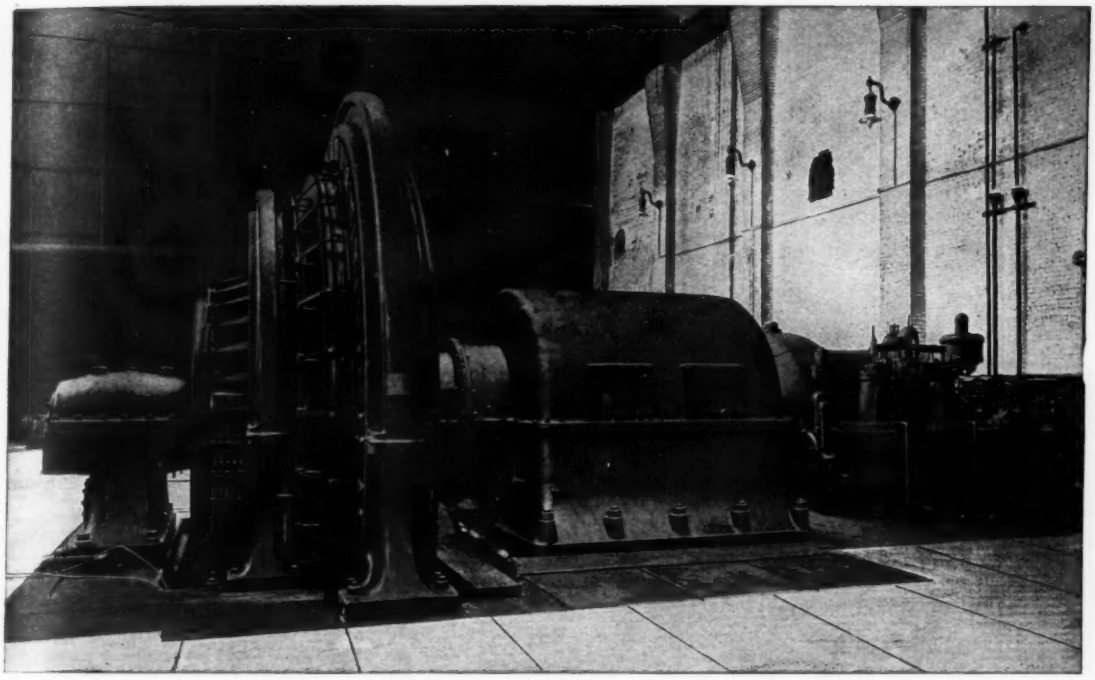
1358 Broadway, New York

Chicago Baltimore Boston San Antonio
Dayton Norfolk St. Louis Atlanta

Pacific Agents: Gorham Fire Apparatus Co.

Seattle San Francisco Los Angeles

The Largest Successful Geared Turbine



One of the two 3750 kw., 275 volt, D. C. Units installed at Cleveland, Ohio. Turbine speed 1800 r. p. m. Generator speed 180 r. p. m.

Successful turbine gearing of large size can only be built by basing the design upon correct principles.

The *floating pinion support* used in Westinghouse gears is the correct means of insuring proper tooth action.

The Westinghouse Machine Company

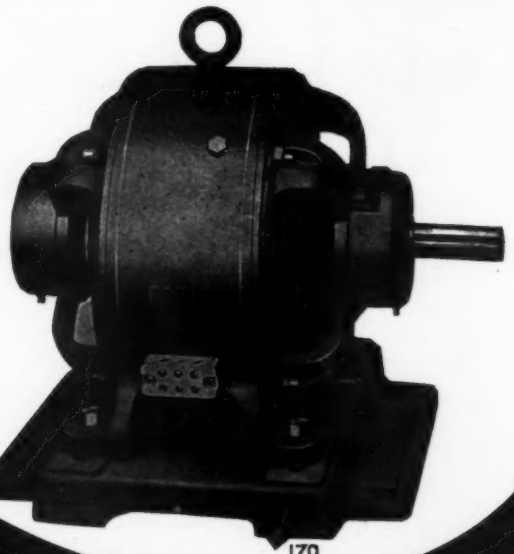
Prime Movers and Auxiliaries **East Pittsburgh, Pa.**

New York, 165 Broadway
Boston, 201 Devonshire Street
Atlanta, Candler Building
Pittsburgh, Westinghouse Bldg.
Cleveland, Swetland Bldg.

Chicago, 39 South La Salle St.
Philadelphia, North American Bldg.
Cincinnati, 1103 Traction Bldg.
San Francisco, Hunt, Mirk & Co.
Denver, 1062 Gas & Electric Bldg.

Mexico, Compania Ingeniera Importadora y Contratista, S. A. (successors to G. & O. Braniff & Co.), City of Mexico

ROTHMOTORS



They prove their worth in operation

In this modern plant Rothmotors and Dynamos are made by machinery of the latest type and every machine is driven by its own individual

Rothmotor

Visitors to the plant are always welcome; it will be an especial pleasure to demonstrate to National Electric Light Association members efficiency methods as applied to the making of motors, dynamos, motor generators, dynamotors, grinders, buffers, forge blowers and special electrical machinery.

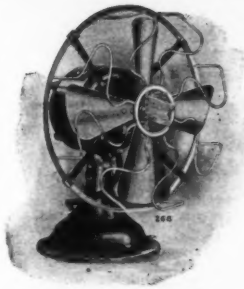
ROTH BROS. & CO.

1404 West Adams Street
CHICAGO

Our 18 Years Experience Is At Your Service

In the field of the small motor and electric fan no concern, we believe, has specialized as we have. Our entire factory and engineering force concentrate on these two forms of electrical devices to the exclusion of everything else. As a result we are prepared to solve not only the ordinary problems of power users, but to plan and execute original methods of securing greater efficiency and economy than has been possible before.

Robbins & Myers "STANDARD" Motors and Fans



Model 11 Oscillating Fan

The confidence reposed in our institution by thousands of satisfied users of "STANDARD" equipment everywhere is intensely gratifying to us. It is an indication of the sort of service you may expect, likewise. We should like the privilege of corresponding with you.

Small Induction-Type

Alternating and Direct Current Fans for Office, Home and Factory

5-inch Residence Type Desk Fan

We make a complete line of Desk, Ceiling, Bracket, Oscillating and Ventilating Fans in a variety of sizes and voltages — swift, silent and extremely serviceable.

Fan orders for special requirements will have immediate attention.

Small Motors of 1/30 to 20 H. P. for Every Purpose

Whether you are a manufacturer of a power driven device or machine or a user of them, our Engineering Board will be glad to confer with you on methods of securing greater efficiency, economy of current and space, cleanliness and convenience through "Standard" motor-drive. Write for special bulletins bearing on your particular problem.

Standard Ventilated-Type Motor

BRANCHES:
New York, Chicago, Boston, Philadelphia, Pittsburg, St. Louis, Rochester, Cleveland, Atlanta, New Orleans.

The Robbins & Myers Co.

Springfield, Ohio

Write our Main Office or nearest Branch for Free Booklets and full particulars regarding either "Standard" Fans or Motors, stating your requirements, and your letter will receive prompt consideration.

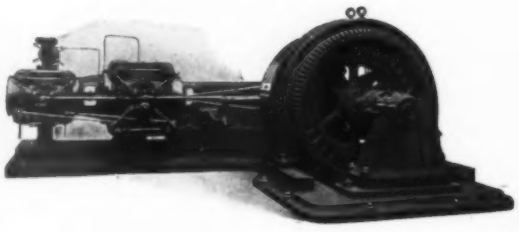
A. C.
Generators
are often spoken of as
ALTERNATORS

D. C.
Generators
might just as well be called
DIRECTORS

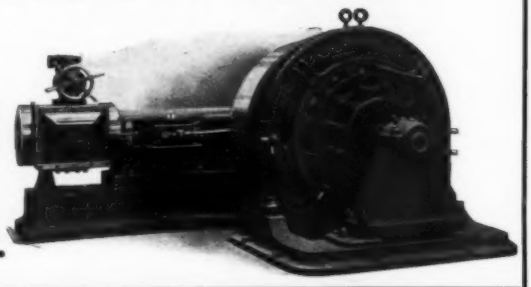
We build both types of apparatus, embodying the best features of modern design and in many respects are a long step in advance of what is best in other makes of equipment offered for similar service. Both A. C. and D. C. apparatus is unique in having the stators built of laminated steel punchings permitting the use of numerous ventilating ducts and the greatest flexibility in design to meet special conditions.

Descriptive bulletins will be mailed on request.

Ridgway Dynamo & Engine Company



RIDGWAY
PENN.



WATSON MOTORS

Have You Used Them Yet?

If you haven't, you better investigate. We make small motors only, A. C. to 45 HP., D. C. to 15 HP., but we make them everlastingly good. Let us send you bulletins.

MECHANICAL APPLIANCE CO.
MILWAUKEE, WIS.

New York, 43 W. 27th St. Chicago, 748 Webster Bldg.
Minneapolis, 618 2d Ave. So. Phila., 1328 Chestnut St.

RICHMOND
POLYPHASE MOTORS
"The Motor Without a Compensator"

Richmond Patented Starting Coils do away with the necessity of using bulky and expensive compensators or auto-starters. Just one point of difference—there are many others of value. ¼ to 150 H. P. Extremely slow speed motors a specialty.

Write for Bulletin 14 R

Richmond Electric Works Richmond, Va.

List of Branch Offices and Sales Representatives

Atlanta, Ga., 72 Marietta St., Fulton Elec. Co.; Baltimore, Md., 204 N. Calvert St., J. S. Dobler; Boston, Mass., 141 Milk St., B. B. Stoddard; Chattanooga, Tenn., Chattanooga Armature Works; Chicago, 322 Monadnock Block, Richmond Electric Works; Cincinnati, Ohio, 126 W. 2nd St., Buckeye Equipment Co.; Dallas, Texas, 1413 Commerce St., Gus Sachs; Houston, Tex. 111 Main St., Borden Electric & Machinery Co.; Louisville, Ky., 514 W. Main St., Harry I. Wood Co.; New Orleans, La., Baronne & Perido Sts., Interstate Electric Co.; New York, N. Y., 145 Chambers St., Richmond Electric Works; Oklahoma City, Okla., 118 N. Broadway, Arnold & Wetherbee; Philadelphia, Pa., 813 Arch St., Richmond Electric Works; St. Louis, Mo., 1318 Pine St., Richmond Electric Works; San Francisco, Cal., 502 Mission St., Hampton Electric Co.; Toledo, O. 226 Huron St., The F. Bissell Co.

COMMONWEALTH EDISON COMPANY

REPAIR SHOPS

32 N. Market Street, CHICAGO Tel. Randolph 1200

FIRST-CLASS EQUIPMENT THROUGHOUT

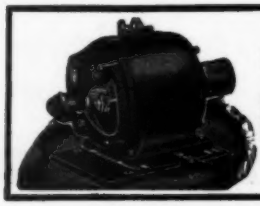
Dynamos, Armatures, Motors, Arc Lamps, Instruments

High Grade Machine Work of All Kinds Correspondence Solicited

C-W Motors Built 25 Years Ago

are still in satisfactory operation. Our quarter century's experience designing and building all kinds of electrical machinery is at the service of every customer, big or little, past, present or prospective. If you are in the market for motors, generators or transformers write for our booklet K on C-W Electrical Machinery.

Crocker-Wheeler Co. **Ampere, N. J.**
Offices in all Principal Cities



Glad to Take Up With You

any questions involving the use of the right dynamos in the right places.

Eck Dynamos

are conservatively rated, honestly constructed, fully guaranteed, have a 12 years record of successful performance behind them and may be had in 50 different frame types—.035 to 15 k. w

Send for Bulletin No. 39.

Eck Dynamo and Motor Co.
Belleville, N. J.

TRIUMPH ALTERNATORS

The Alternator par excellence for both motor and lighting loads

Triumph Alternators will carry their full rating at 60 per cent power factor or lower, showing excellent regulation without the use of any form of automatic regulator, yet high efficiency is maintained at both 60 per cent power factor and 125 per cent load.

Good regulation on inductive load is a most important feature, particularly when a motor load is carried, as otherwise the fluctuation in voltage would cause unsatisfactory performance generally.

The ability of Triumph Alternators to maintain constant voltage is of tremendous value to Central Stations operating metallic filament lamps, in that the freedom from excessive voltage blows insures the maximum lamp life hours.

Specify "Triumph" to obtain these essentials of efficient and economical operation. Write for Bulletin 481 in order to obtain full information.

The Triumph Electric Company

Cincinnati, Ohio

New York	Boston	Cleveland	Philadelphia	Baltimore
Pittsburgh	Chicago	Detroit	St. Louis	St. Paul
	Chattanooga	Atlanta	San Francisco	

Scientific management is founded on the doctrine of

elimination or utilization of waste; whether waste motion or products.

Thirty-six years of experience enable us accurately to estimate the income you may derive from selling what you now waste—**exhaust steam.** The heating business in your town legitimately belongs to you and the profits can be yours if you develop the field by aid of the

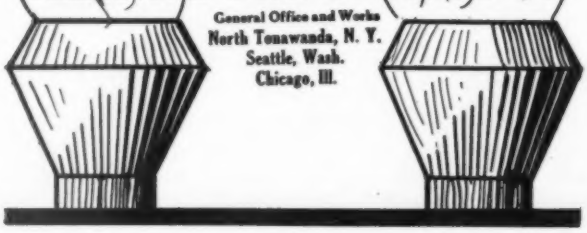
American District Steam Co.'s Heating System

Over 1,000 miles of underground mains are being operated by our system. Hundreds of Central Stations pay their entire operating expense out of the profits derived from the sale of exhaust steam.

Exact figures on the additional income you may expect from operating a combination power, electric light and heating plant will be furnished by our engineers without cost to you. The first step is to read our book. Send for it.

American District Steam Co.

General Office and Works
North Tonawanda, N. Y.
Seattle, Wash.
Chicago, Ill.



TOOLS OF QUALITY

"MORSE"

Twist Drills, Reamers, Cutters, Taps, Dies, Etc.

For half a century "MORSE TOOLS" have represented the highest type of tool perfection. As the result of years of experience their reputation is first-class and world-wide.

The continued patronage of "MORSE" customers proves satisfaction.

Selected material of the highest grade in both carbon and high speed steel combined with up-to-date methods produces QUALITY TOOLS.

Send for Illustrated Catalog—Free

Morse Twist Drill & Machine Co.

New Bedford, Mass., U. S. A.

"Wagner, Quality" is the trademark of the **Wagner Electric Manufacturing Company, St. Louis**—third in importance among the manufacturers of electrical machinery in the United States. The Wagner Company are specialists. They do not strive to cover the whole field of electrical power apparatus. Their aim is that the machinery they do produce shall be as thoroughly good and serviceable as it is possible to build.

The Wagner Electric Company have been the pioneers along many lines in the development of alternating current machines and devices. Witness such noteworthy achievements as the development of the commercially successful Single-Phase Motor and the more recent and remarkable Single-Phase, Unity Power-Factor Motor. As the equipping of the first 10,000 volt and the first 40,000 volt power circuits. As the invention of the single-phase converter. As the invention of the low voltage, low current alternating current rectifier. As the production of a line of electrical instruments for switchboard and portable work unequaled in scope and diversity. It is this combination of originative ability and constructive capacity that justifies the appellation "Wagner, Quality."

SALES OFFICES

Boston, Mass., 110 State St.
Buffalo, N. Y., Electric Bldg.
Chicago, Ill., Marquette Bldg.
Cincinnati, O., First National Bank Bldg.
Cleveland, O., New England Bldg.
Denver, Colo., Mine & Smelter Supply Co.
Detroit, Mich., Ford Bldg.
El Paso, Tex., Mine & Smelter Supply Co.
Kansas City, Mo., Waldheim Bldg.
London, England, Clifford's Inn.
Los Angeles, Cal., Pacific Electric Bldg.
Minneapolis, Minn., Security Bank Bldg.
Mexico City, Mex., Mexico Mine & Smelter Supply Co.
New Orleans, La., 205 Chartres St.
New York, N. Y., 30 Church St.
Philadelphia, Pa., Real Estate Trust Bldg.
Pittsburgh, Pa., 422 First Ave.
St. Louis, Mo., 6400 Plymouth Ave.
Salt Lake City, Utah, Mine & Smelter Supply Co.
San Francisco, Cal., Rialto Bldg.
Seattle, Wash., Pacific Block.
Sioux City, Ia., 515-517 Fifth St.
Wagner Electric Mfg. Co. of Canada, Limited, Guardian Bldg., Montreal.

Wagner Electric Manufacturing Company,
Saint Louis, Missouri

2215

FOSTER'S

ELECTRICAL

Completely Revised

ENGINEER'S

and Enlarged

POCKET BOOK

1600 pp. 1128 Ill. 718 Tables

IN FOSTER'S ELECTRICAL ENGINEER'S POCKET-BOOK is concentrated all electrical engineering knowledge, collected, collated, tabulated, fully illustrated, and revised to include the very latest practice.

This book is the product of the combined efforts of the brightest minds engaged in electrical engineering. Each section has been revised and corrected by a master specialist in its subject. Foster reflects all that is latest and best in every department of electrical endeavor.

Foster supplies in a small space, and at the same time very exhaustively, all the information and data electrical engineers, designers or workmen require in their daily work. The important formulas and adopted standards are carefully elucidated and their practical application indicated.

No other electrical book ever published contains so much valuable data, and the matter in Foster is to be found nowhere else in such complete, exhaustive and comprehensive form.

The Seventh Edition

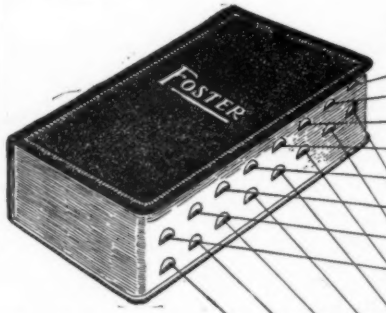
1913

In its present shape this important book has had the benefit of years of usé by the whole electrical profession. Even the very smallest inaccuracies have been righted and recently the whole book has had a very thorough revision. Every page fairly bristles with information that it would be troublesome to find elsewhere.

The Seventh Edition contains, therefore, all the data, all the information—to the very last word—on electrical matters for which you can have any possible use. And the fact that six editions were required in so short a time proves how much in demand it is by those whose work is in matters electrical.

HERE IS A LIST OF THOSE WHO HAVE CO-OPERATED WITH HORATIO A. FOSTER IN THE MAKING OF HIS GREAT BOOK — ALL SPECIALISTS:

A. H. Armstrong	Samuel Sheldon
Wm. Mayer, Jr.	F. B. Crocker
Clayton H. Sharp	M. Arendt
J. B. Baker	Lamar Lyndon
W. Wallace Christ	J. J. Crain
M. W. Franklin	W. N. Goodwin, Jr.
Edw. Lyndon	E. M. Hewlett
J. Haliberg	Max Loewenthal
A. A. Knudson	Alex. G. McAdie
W. S. Moody	E. B. Raymond
F. A. C. Perrine	C. Renshaw
G. H. Powell	C. J. Spencer
K. C. Randall	N. W. Storer
B. P. Rowe	F. K. Vreeland
J. Frank Stevens	Cecil P. Poole
Charles Thom	H. W. Young
J. Lloyd Wayne, 3d	Harold Pender
Townsend	Wolcott



Patent Thumb Index Sections

- Units, 130 pp.—137 Ill.—30 Tables.
- Condensers, 167 pp.—84 Ill.—159 Tables.
- Symbols, 36 pp.—38 Ill.—16 Tables.
- Dynamos, 107 pp.—116 Ill.—27 Tables.
- Transformers, 57 pp.—101 Ill.—3 Tables.
- A. I. E. E. Rules, 27 pp.—2 Tables.
- Lighting, 94 pp.—41 Ill.—42 Tables.
- Railways, 231 pp.—222 Ill.—112 Tables.
- Trans. of Power, 6 pp.—1 Ill.—1 Table.
- Storage Batteries, 34 pp.—27 Ill.—3 Tables.
- Switchboards, 134 pp.—166 Ill.—20 Tables.
- Telegraphy, 28 pp.—24 Ill.—3 Tables.
- Telephony, 150 pp.—120 Ill.—28 Tables.
- Electrochemistry, 59 pp.—34 Ill.—24 Tables.
- Mechanical, 243 pp.—37 Ill.—230 Tables.
- Index, 67 pp.—

Delivered on to Your Desk, Carriage Free,

$5.00

For quick and easy reference this book is a marvel. The sixty-seven page index is as complete as the limits of manipulative facility will permit and affords the fastest means of locating the information sought. This is supplemented by an excellent table of contents, and besides, the PATENTED THUMB INDEX TABS, separating each division of the book, make reference practically instantaneous. You couldn't want to find anything in the book with more ease or rapidity.

Table of Contents

Symbols, Units, Instruments
Measurements
Magnetic Properties of Iron
Electromagnets
Properties of Conductors
Relations and Dimensions of Conductors
Underground Conduit Construction
Standard Symbols
Cable Testing
Dynamos and Motors
Tests of Dynamos and Motors
The Static Transformer
Standardization Rules
Illuminating Engineering
Electric Lighting (Arc)
Electric Lighting (Incandescent)
Electric Street Railways
Electrolysis
Transmission of Power
Storage Batteries
Switchboards
Lightning Arresters
Electricity Meters
Wireless Telegraphy
Telegraphy
Telephony
Electricity in U. S. Army
Electricity in U. S. Navy
Resonance
Electric Automobiles
Electrochemistry
Electrometallurgy
X-rays
Electric Heating, Cooking and Welding
Lightning Conductors
Mechanical Section
Index

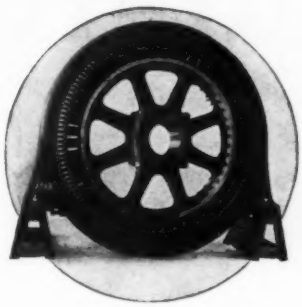
D. Van Nostrand Company

23 Murray St. NEW YORK 27 Warren St.

Publishers and Sellers of Electrical Literature

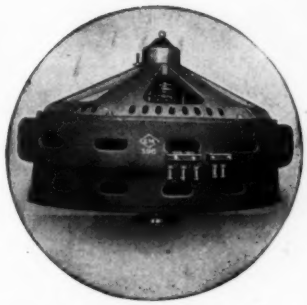
ELECTRIC MACHINERY CO

MINNEAPOLIS E M MINNESOTA

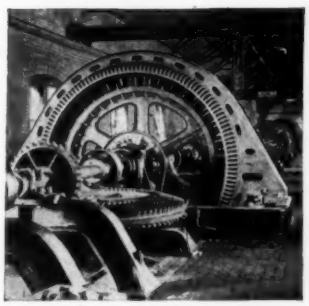


The modern doctrine of efficiency demands the installation of apparatus designed to

produce definite results

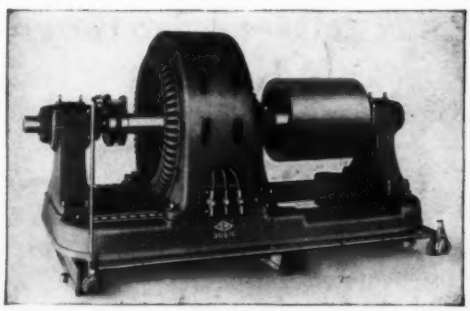


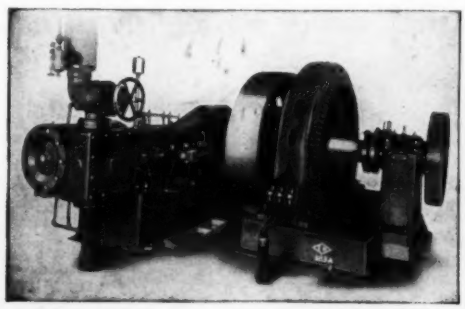
Generators, Switchboards, Motors, Synchronous Motors, Etc.



bearing **E M** name plates not only meet the requirements of efficiency engineering by being moderate in first cost and absolutely dependable in performance, but their rugged and durable construction insures sustained efficiency throughout long life. We have a complete line of types and sizes.

The co-operation of our Engineering Department is always at your service.
Write for Bulletins





HEMINGRAY

Standard Glass Insulators

For 50 years our Glass Insulators have given steady, efficient, satisfactory and economical service on Telephone, Telegraph, Electric Light, Railway and Power lines. For both high and low voltages, careful tests show that Hemingray Glass Insulators have large factors of safety above the voltages they will be called upon to carry.

Ask for our Booklet—"Some Interesting Facts about Hemingray Glass Insulators"

Hemingray Glass Co.

Established 1848 **COVINGTON, KY.** **Incorporated 1870**

FACTORIES, MUNCIE, IND.

"Safety Strain" Insulators

1,000 to 1,000,000 Volts

The Court of Appeals of the District of Columbia, on April 7th, 1913, handed down its decision affirming the decision of the Commissioner of Patents, dated August 6th, 1912, which decision awarded priority of invention of the subject matter of U. S. Patent, No. 904,370, November 17th, 1908, to

LOUIS STEINBERGER

President and General Manager, Electrose Mfg. Co.

This patent is basic and covers Disk Strain Insulators provided with protective parts.

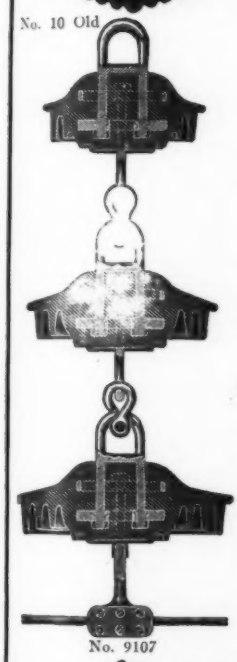
The decision is final—there is no appeal.

ELECTROSE "SAFETY STRAIN" INSULATORS

Highest degree of electrical resistance combined with greatest mechanical strength.

Loops and Disks of drop-forged steel.

Adapted for all requirements of electrical transmission, railway service, and wherever high tension currents are used.

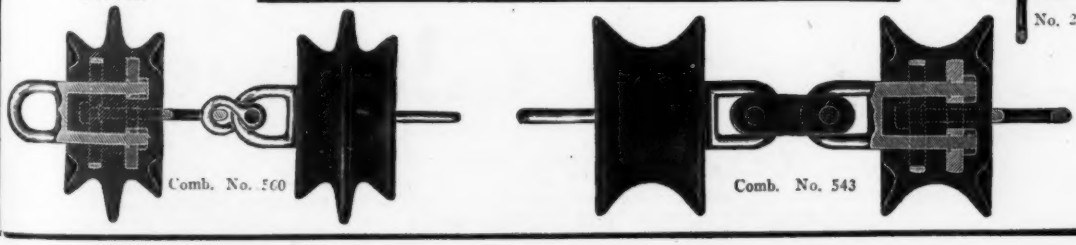


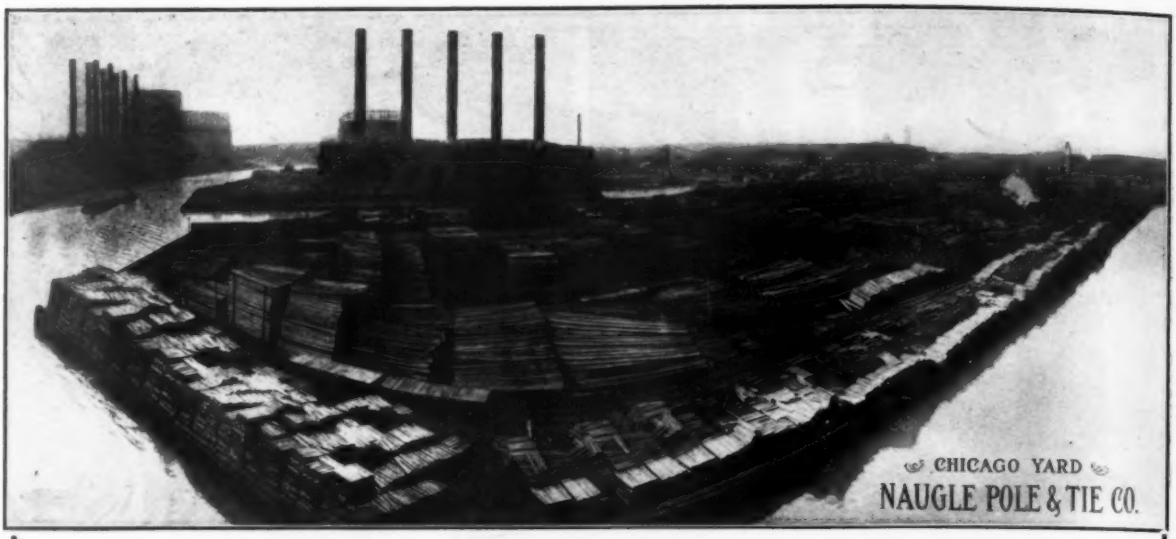
ELECTROSE MFG. CO.

60-72 Washington Street
66-76 Front Street
} BROOKLYN, N. Y.

Also for Sale by

Western Electric Company





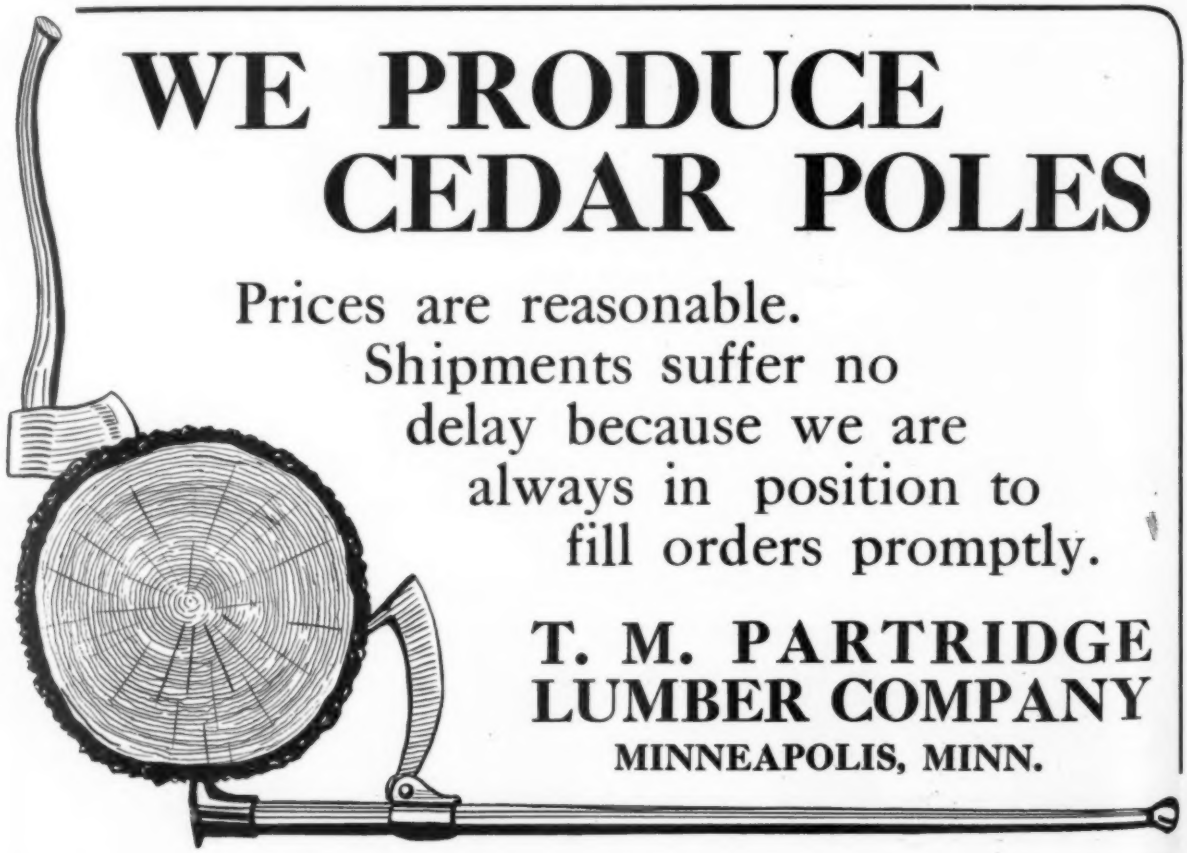
WE SPECIALIZE in poles of the longer lengths, which are especially suitable for Transmission work, carrying what we consider to be the largest stock of poles in the country, and concentrated in yards for immediate delivery.

May we show you this yard at your convenience during convention week?

Naugle Pole and Tie Company

Suite 1802—5 South Wabash Avenue Chicago, Ill.

WE PRODUCE CEDAR POLES



Prices are reasonable.
Shipments suffer no delay because we are always in position to fill orders promptly.

T. M. PARTRIDGE LUMBER COMPANY

MINNEAPOLIS, MINN.

Butt-treating Cedar Poles with genuine C-A-Wood Preserver

WESTERN or NORTHERN CEDAR POLES

Our facilities for promptly supplying your Cedar Pole requirements have not been affected by the prevailing scarcity. We can make immediate shipments from our large stocks carried in the St. Maries, Idaho, or Minnesota Transfer yards. *Open tank butt-treated with genuine C-A-Wood Preserver if you wish.*

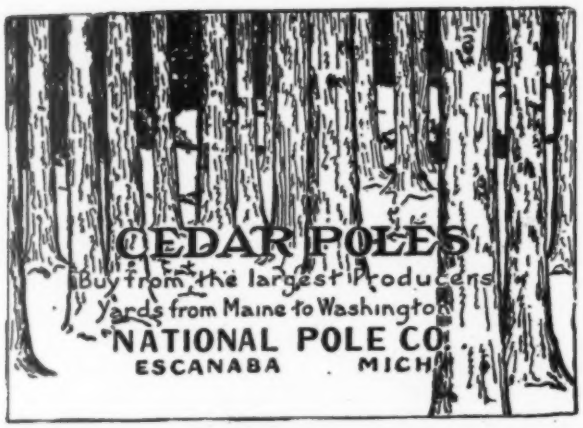
See Our Exhibit, Booth 52, at the National Electric Light Association Convention

The Valentine-Clark Co.

General Offices, Minneapolis, Minn.

SALES OFFICES:

Chicago, Ill. **Toledo, Ohio** **St. Maries, Idaho**



DIXON'S GRAPHITE BRUSHES
Are most economical because the most durable
JOSEPH DIXON CRUCIBLE CO.
JERSEY CITY NEW JERSEY

C. O. BAKER, Pres. C. W. BAKER, Vice-Pres.
PLATINUM
Wire, Sheet, Rivets and Contacts—
Wollaston Wire for Wireless Telegraphy—
All of Baker Standard Quality—
BAKER & CO., INC.
NEW YORK OFFICE, 30 Church Street 408 N. J. R. R. Ave., NEWARK, N. J.

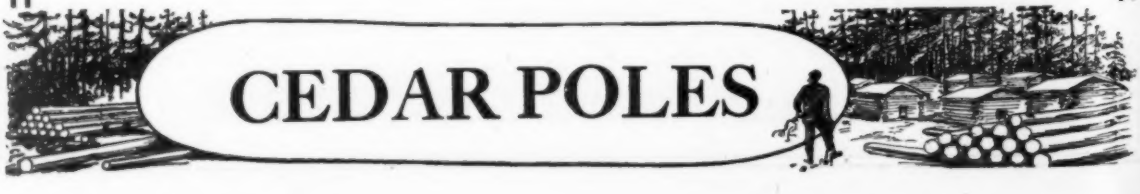
POLES
NORTHERN WHITE CEDAR WESTERN RED CEDAR
BUTT TREATING
PAGE & HILL CO.
MINNEAPOLIS, MINN.

PATENTS TRADEMARKS and COPYRIGHTS
Send your business direct to Washington. Saves time and insures better service. Personal Attention Guaranteed. 30 Years Active Practice.
Write for terms—Book free.
E. G. SIGGERS, Patent Lawyer
Suite 20-25 National Union Building, Washington, D. C.

The Brady Mast Arms
THE BRADY ELECTRIC MFG. CO., NEW BRITAIN, CONN., U. S. A.
Manufacturer of
MAST ARMS, POLE and SWITCHING HOODS, HOUSE BRACKETS and other specialties for construction work
Catalogue and Prices Furnished on Application

PROGRAM CLOCKS
Are a great modern convenience in schools, colleges and other large buildings where automatic signals are desired. By their use any number of different bells in any number of different rooms may be rung at any time desired during the day.
ALSO 60-DAY, ELECTRIC WATCHMAN'S AND FRYING-PAN CLOCKS. Send for Catalogue No. 207.
The Prentiss Clock Improvement Co. 12 Chambers St. Dept. 20 New York City

We can make prompt shipments of
MICHIGAN
AND
WESTERN CEDAR POLES
Write or wire your requirements.
CRAWFORD CEDAR CO.
MENOMINEE, MICH.



WESTERN DOUGLAS FIR
CEDAR POLES CROSS ARMS
THE LINDSLEY BROTHERS COMPANY
PEYTON BUILDING "GOOD POLES QUICK" SPOKANE, WASHINGTON

Any Quantity. Prompt Shipments
CEDAR POLES
BRADLEY TIMBER & RAILWAY SUPPLY CO.
DULUTH MINN.

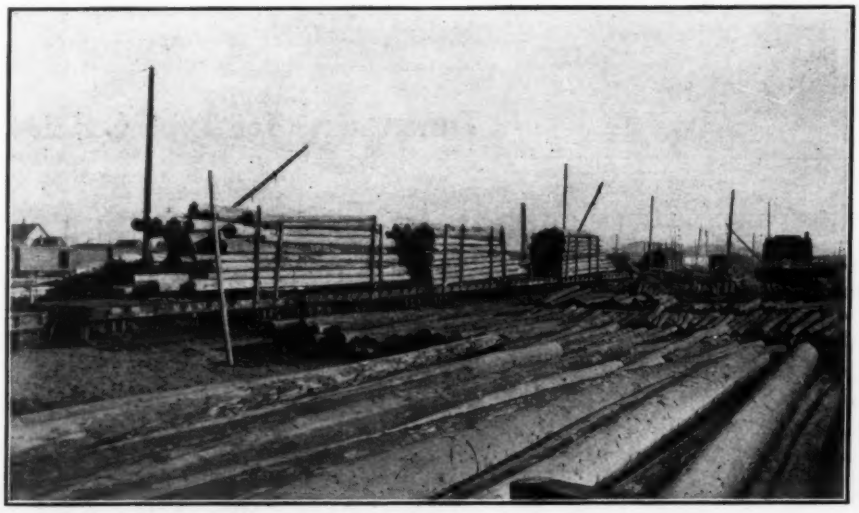
IDAHO RED CEDAR POLES
Sandpoint Lumber & Pole Co., Ltd.
SANDPOINT, IDAHO
Large Stocks-Prompt Shipments
Good Quality - Right Prices

WESTERN CEDAR POLES
We brag about the Service we give
B. J. CARNEY & CO.
E. B. BRANDE, Manager 810 Broad Street GRINNELL - IOWA
M. P. FLANNERY, Manager 606 Paulsen Bldg. SPOKANE - WASH.
Commit Us to Memory

W. C. STERLING & SON CO.
POLES OF STERLING QUALITY
Oldest Cedar Pole Firm in Business Producers for 33 Years
MICHIGAN and WESTERN CEDAR
W. C. STERLING & SON COMPANY
1880 MONROE, MICHIGAN 1913

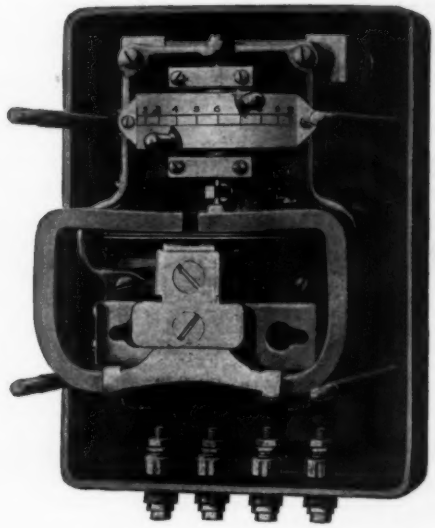
CEDAR POLES
Write for Prices. We can save you money.
TORREY CEDAR CO. Clintonville, Wis.

POLES SERVICE



DULUTH LOG CO., Duluth, Minn.

Westinghouse Type C Relay



A Selective Relay

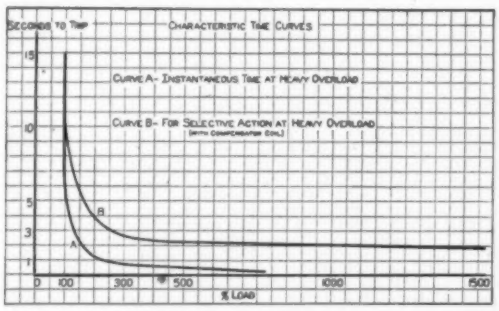
For A. C. Overload — For A. C. Reverse Power

OPERATES on the induction principle, and is **the only Reverse Power Relay** on the market for alternating-current service.

It may be used for both overload and reverse power protection, or, in combination with a selective element, for reverse power only.

When installed in substations the Reverse Power Relay affords protection to parallel feeder circuits. In the event of a short circuit, or ground, on one feeder, the reversal of power completely isolates this feeder.

For overload protection this relay may be provided for instantaneous operation at extreme overloads, or to give an adjustable minimum time element at extreme overloads.



WESTINGHOUSE A.C. OVERLOAD RELAYS

Time Curves for Type C Relay

Curve "A" shows instantaneous time at extreme overload.

Curve "B" shows minimum time element at extreme overload.

With different time settings on the instrument a number of curves parallel to these can be obtained, varying the time on the flat part of the curve from 0 to 2 seconds. If desired, special relay can be furnished to give up to 10 seconds minimum.

Westinghouse Electric & Manufacturing Co.

Sales Offices in 45 American Cities **East Pittsburgh, Pa.**